GENERAL LIBRARY
UNIV. OF MICH.
JUL 1 1925

The ELECTRICAL REVIEW

FOUNDED 1872

VOL. XCVI. No. 2482. | [All Rights Reserved.] | JUNE 19, 1925. | [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] | PRICE SIXPENCE.

LITHOLITE INSULATORS, Ltd.
55–57, Hackney Grove, London, E. 8.
Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES
ESTABLISHED OVER 20 YEARS.

SHEET ELECTRIC INSULATION, MOULDINGS
NON-HYGROSCOPIC, FIREPROOF.
SILUMINITE
The SILUMINITE INSULATOR Co., Ltd.
THE GREEN, SOUTHALL, MDLX.
'Phone and 'Gram: SOUTHALL 59.

FERGUSON, PAILIN, LTD.,
SPECIALISTS IN
SWITCHGEAR.
Higher Openshaw, Manchester.
Phone: OPENSHAW 322. 'Grams: TENSION, MANCHESTER.

RESISTANCE MATERIALS
Asbestos Woven Resistance Grids. Resistance Cord. Resistance Wires & Tapes.
CRESSALL MANUFACTURING CO.,
Staniforth Street, BIRMINGHAM.
Telegrams: "Ohmic, Birmingham." Telephone: Central 3463.

INSTRUMENTS, CIRCUIT-BREAKERS,
AUTO-CUT-IN & CUT-OUTS
The Record Electrical Co., Ltd.,
BROADHEATH, MANCHESTER.
TELEPHONE: 164 ALTRINCHAM.

"HEATRAE" Registered.
ELECTRIC FIRES, Ltd., NORWICH.
See Page iii. next week.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON.

"CANTIE"
IRONCLAD SWITCHBOARDS
CHEAP, EFFICIENT, ROBUST.
CANTIE SWITCH CO., LTD.,
LEICHTON ST. NOTTINGHAM.

SAXONIA ELECTRICAL WIRE CO., LTD.,
Est. 1895. GREENWICH, S.E. 10.
EXTRA FLEXIBLE CABLES and CORDS.
DYNAMO and TRAILING LEADS,
V.I.R. and Asbestos covered.
CIRCULAR and OVAL FLEXES.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

Cutting
Electric Motors.
CUTTING BROS., LTD., STAMFORD
Telegrams: Cutting, Stamford. Tel. No. 18

"EMPIRE"
HIGH TENSION LINE EQUIPMENT
Pole type Switches, Choke Coils, Disconnecting Switches, Fuses, Lightning Arresters, Pole type Units up to 132,000 v.
Ask for Free Descriptive Matter.
ELECTRIC CONTROL LTD.,
EMPIRE WORKS, GLASGOW.
Birmingham, Leeds, London, Manchester, Swansea, Australia, New Zealand, South Africa and Shanghai.

For REWINDS of . . .
Every Description,
CONSULT
BURDETTE & Co., Ltd.
'Phone: Hop 4572 & 3063.
5, POCOCK STREET, BLACKFRIARS, S.E. 1.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Connaught House, Aldwych, W.C. 2.
Works. NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
Electrical Household Domestic Appliances.
See Advertisement this week, page xlvi.

A. MARTELLI
The Alabaster King.
NEW ADDRESS (10-times Larger Premises),
NEW PATTERNS, NEW PRICES.
CARVED BOWLS AT PLAIN BOWLS PRICE.
15, Gerrard Street, W. 1.
Gerrard 4312 (2 lines). Cables: "Agatina, London."

COILS "KAYBEE" ELECTRIC WASH THE ARMATURE WINDING CO., LTD. 44a, Bolton Street, BURY, LANCASHIRE REWINDS BOILER.

E. DAWSON & CO.,
LAMPS (AS USUAL).
In addition
Wireless Valves, Crystal and Valve Receiving Sets, Head 'Phones, &c.
10, Gray's Inn Road, London, W.C. 1.
(Phone: Holborn 2794.)

JULIUS SAX
Specialists in
EST. **BELLS** 1855.
and
Wall Plugs.
24a, High Street, Bloomsbury, W.C.2.

The Car and the Candle.
See Sup. 10.

MOTORS
BY
McClure & Whitfield,
Small Power Dynamo Co., Ltd.
Agents
CITY ELECTRICAL CO., 1, Emerald Street, LONDON, W.C. 1.

VINCENT
Important— *See page xxii.*

a **ARMOURING**
for Car Lighting Leads.
Effective and Economical in
ALUMINIUM
The British Aluminium Co., Ltd., 109, Queen Victoria St., London.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS.
SWITCHGEAR.

CURTIS MFG. CO.
CONDUIT PLACE, PADDINGTON, LONDON, W. 2
RESISTANCES (SLIDING RHEOSTATS).
OF CONSTANT RATING FOR ALL PURPOSES.

ZENITH
MANUFACTURING CO.
REGULATING RESISTANCES
"ZENITE" EMBEDDED RESISTANCE UNITS
SPECIAL TRANSFORMERS
ZENITH WORKS, VILLIERS ROAD, WILLESDEN GREEN, LONDON, N.W. 2.

FULLER'S UNITED ELECTRIC WORKS, LIMITED.
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES EBONITE
WIRELESS APPARATUS CARBON BLACK
Head Office:
(General Sales Offices and Works).
WOODLAND WORKS, GROVE ROAD, CHADWELL HEATH, ESSEX.

BETTER JOBS.
M.E.M. *See page xl.*

Advertisement Index, see page lvi. *Official Notices, see Sup. 36.*

THE
YORKSHIRE COPPER WORKS, LTD.,
LEEDS, ENGLAND.
SPECIALISTS IN THE MANUFACTURE OF
CONDENSER TUBES
For Power-Station Condensing Plant, in all Standard and Special Alloys, including "Benedict."
SOLE MAKERS **"BEMAL"** BRASS CONDENSER TUBES. **"BENEDICT"** CONDENSER TUBES.
(Regd. Trade Names.)

H.
EBONITE
OF ALL STANDARD QUALITIES AND TO ALL USUAL SPECIFICATIONS.
SEPARATORS, BOXES & FITTINGS FOR ACCUMULATORS OF ALL TYPES.
PUMPS. TAPS. PIPES. &c. for CHEMICAL ENGINEERING.
SOLID EBONITE HORNS FOR LOUD SPEAKERS. The non-resonant properties of Ebonite is now being fully recognised by wireless manufacturers and the demand for these to replace metal and similar horns is rapidly extending. We have the *experience of years* behind us in this specialised branch and would be glad to place same at your disposal. Let us send you our illustrated list.
EBONITE FOR ALL WIRELESS PURPOSES. 100% EBONITE ONLY. EBONITE FOR ALL ELECTRICAL INSULATION.
WHOLESALE ONLY. SEND US YOUR ENQUIRIES OR WRITE FOR LIST.
HIGHTENSITE & EBONITE MFG. Co., Ltd.,
'Phone: EAST 3153. NORMANDY WORKS, CUSTOM HOUSE, LONDON, E. 16. E.

Mica Micanite
Insulators for every description of Electrical Work.
Superfine "MICAYLOR" Diaphragms for Sound Boxes.
Taylor & Petters, Ltd. 30 Hatton Garden, London, E.C.1. Telegs. "Micaylor, London." 'Phone: Holborn 2361.
We supply 3 Million Condenser Plates Weekly to the Magneto & Wireless Trades.
We specialise in Cutting, Gauging & Machining

THE ORIGINAL COMMUTATOR GRINDING BLOCK.
The **ONLY** BRITISH MADE BLOCK ON THE MARKET.
— *Cheapest and Best.* —
Commutator Blocks 4" to 30" dia.
Slip-Ring Blocks 12" to 30" dia.
All Standard Sizes in Stock. Special Sizes to Order

PRICES: 6/- to 17/6

The COMMUTATOR GRINDING BLOCK Co.
16, WEST BLACKHALL ST., GREENOCK.
Telegrams: "Grinding, Greenock." Telephone: 776 Greenock.
SOLE LONDON AGENTS:
COLLINS ELECTRICAL LIMITED,
115, CLERKENWELL RD., LONDON, E.C.1.
Telegrams: "Colarmairs, Holborn, London." Telephone: Holborn, 212[illegible]213.

The best INSULATING VARNISHES obtainable.
"OHMALINE" BLACKS. No. 68, Air Drying. No. 157, Flexible Stoving. No. 166, Hard Drying. No. 936 Maximum of impregnation.
"ARMACELL" CLEAR GOLDEN STOVING. No. 213, Flexible. No. 317, Harder Drying. **All Applicable by Dipping or Vacuum Impregnation.**
"INSULDERM" Grey Heat Radiating Enamel. **"STICOLINE"** for building up Mica. **"PAKYDERM"** finishing.
"SHAYDOLITE" for colouring lamps. **"ANTI-SULPHURIC" ENAMEL** for Battery Rooms. **"ARMOURITE"** Synthetic Varnish.
The Oldest All-British Insulating Varnish Makers:
GRIFFITHS BROS. & Co. LONDON, LTD., Bermondsey, London, S.E. 16.

The

Electrical Review

VOL. XCVI. JUNE 19, 1925. No. 2,482.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address "AGEEKAY, CENT., LONDON." Code, A B C. Telephone Nos.: Central 8260 and 8261

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.: Canada, £1 12s. 6d.: Colonial and Foreign, £2 1s. 6d. per annum Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

LIST OF FOREIGN AGENTS (see first page "Official Notices").

Contents:

	PAGE
Confidence in Electrical Securities	961
Wages in the Engineering Industry	962
The Progress of Radio-telephony	962
The I.M.E.A. Convention	963
The German Stinnes Group	963
The Institution of Electrical Engineers (*illus.*) (*continued*)	964
Charges for Electricity, by Thomas Carter	965
Welding—the Filling-in and Putting-on Tool, by W. R. Needham	967
This Puzzling Power Factor by "Stan Dard"	970
Investigations on the Structure of Quenched Carbon Steels, by B. D. Enlund (*illus.*)	971
Reviews	972
Business Notes	973
Lighting and Power Notes	974
Tramway and Railway Notes	976
Telegraph and Telephone Notes	976
Radio Notes	977
Contracts Open and Closed	977
Works Visited by the I.E.E. (*illus.*)	979
An Association to Watch over Trade Matters	983
Forthcoming Events	983
Notes	983
Institution Notes	985
Our Personal Column	985
New Companies Registered	986
Official Returns of Electrical Companies	986
City Notes	986
Stocks and Shares	990
The Shannon Power Scheme, by P. T. White	991
The Incorporated Municipal Electrical Association (*illus.*)	992
Selected Radio-telephone Apparatus (*illus.*)	995
The Manchester Electricity Supply and Tramway Undertakings	996
Power on the Farm in U.S.A. (*illus.*)	997
Legal	997
Belgium's Electrical Trade	998
Parliamentary	998
Current-carrying Capacities of Solid Copper and and Aluminium Conductors	998
Correspondence—	
The History of the Telephone in the United Kingdom	999
Heating Water	999
Lead-covered Wiring and Visible Bonding	999
Luminous Electric Radiators	999
The Electrocution of Rats	1000
Published Specifications	1000
Contractors' Column	Advertisement page xxxvi

Confidence in Electrical Securities.

THE American *Electrical World* devotes an editorial comment to the responsibility that rests upon the electrical industry to watch and confute those who would unscrupulously exploit its great and growing prosperity and so cast discredit upon its good name.

Across the Atlantic, as well as on this side, electrical utility securities are rightly in favour with the investor at present, and the opening that exists everywhere for enormous electrical expansion will, if sound financing is rigidly enforced, mean, in our contemporary's words, that "the popularity of electrical securities as outlets for savings in the next two decades will almost exceed belief."

At certain periods during the last year or two caution has had to be published in this country respecting the efforts of certain promoters to float their unpromising ventures on the tide of electricity supply prosperity. But all the warnings that are issued in these pages and in the columns of the financial Press do not suffice to stop the flow of the prospectuses of these schemes through the post. The strange thing about it is that these documents, so worded as to be palpably ridiculous in the eyes of those who know the essentials of electricity supply finance, are being received by electrical men. A number of them have been passed on to us from such sources. Enough has been said to place electrical men on their guard; the danger that they will be tempted perturbs us less than does the fear that harm will be done among the general uninitiated public who read neither the electrical journals nor the financial papers, and who, if reports be not unfounded, are being heavily circularised through the post. Very scathing attacks have been made upon the projects, but still the activity continues.

The Electricity Commissioners have reason for knowing something about these matters, but their powers for dealing therewith are limited and can only be effective under certain circumstances. It seems a pity, though, that the non-electrical public should be induced to part with their money with such little hope of a return without any hand being put out for their protection, but we live in a free country, and it so often happens that hope of redress has to be deferred until it is too late to get one's money back.

We have faced this unsatisfactory situation so frequently of late that we read our New York contemporary's editorial somewhat closely in search of the remedy, only to find that it has little to offer, for: "The State Commissions can do little to control the situation through their regular supervision over local companies' securities, and the only remedy seems to be *education as to what constitutes a sound investment.*" Such education "aside from federal supervision with all its drawbacks" is described as the only remedy. When we call for bread we find this a very hard cold stone. Our contemporary offers another suggestion as well, when it remarks that a very real responsibility rests with the investment banker and the public utility man to co-operate in seeing to it that the public is told the truth about every issue of utility securities offered for sale in its territory, and that unworthy securities are exposed to the light of economic analysis and publicity wherever and whenever they are placed on the market. But even this suggestion has little application to local issues which are made through the post and seek no Press publicity.

It is perfectly true, as our contemporary remarks, that the temptation of prosperity attracts the unscrupulous, but when it says that "the industry" must keep its eyes open and see to it that unworthy interests do not exploit the public in the name of electricity, we find ourselves wondering which particular association, organisation, agency or individual, is armed with either the responsibility or the backing to enable it to act as the industry's representative.

The trade Press has information, and it has both the willingness and the voice to make itself heard, but its problem is how to reach the right people; the Electricity Commissioners have knowledge and they have certain powers, but these, as we say, they can only exercise under certain circumstances; the Public Prosecutor has powers, but they, too, it may be, can only be exercised after the mischief is done. Meanwhile the poor deluded, in need of "education as to what constitutes a sound investment," have to suffer while "the industry" is enjoined to keep its eyes open.

We wish that our contemporary had been a trifle more explicit; perhaps the American electrical constitution includes somewhere or other in its ramifications an organisation which assumes this educational duty of preventing others from rushing in where the elect ones fear to tread. Or it may be that the American equivalent of our Electrical Development Association shoulders the responsibility on the ground that it must try to counteract all influences that would bring electrical expansion into disrepute. We think that on this side Mr. Beauchamp and his staff have quite heavy enough duties in hand and in prospect; and it cannot be said that the *rôle* of financial investigator and adviser would be a legitimate one for the B.E.A.M.A.; but there is a Committee of Provincial Electric Supply Companies which may not think itself unaffected by undesirable finance within its particular field of action.

The evil has not reached large dimensions, and the amount involved may not be heavy, but the continued circulation of absurd statements and promises is worse than irritating, and it cannot fail to do the electrical industry harm whether money be lost or not.

We should not give this subject so much prominence were we not convinced that during the next few years the electrical industry will be appearing before the investing public with invitations to it to subscribe many millions of pounds of new capital. The growth of the industry in certain particular directions during the last year or two has been so sudden, erratic, and irregular as to produce a constant stream of failures which unfortunately form too large a part of the trade news of the week. That aspect of industrial affairs has been dealt with fully already, and constructive propositions have been advanced. The financial soundness of the industry in other and larger connections must be safeguarded so that there may be an uninterrupted flow of investment as the outcome of well-grounded confidence in electrical development. Some good could be done by every reader of the ELECTRICAL REVIEW influencing his own particular social circle by discountenancing doubtful schemes whenever he has an opportunity of so doing, though this is a piece of educational work that requires to be done with considerable discretion or the remedy may be worse than the disease, and fear may be engendered which will bring all electrical securities into bad odour.

Wages in the Engineering Industry.

THERE takes place to-day (Friday) a further meeting of representatives of the engineering trade unions to consider the last letter received from the Engineering and Allied Employers' Federation upon the subject of wages in the industry.

The employers have shown that British engineering industry is hard pressed by Continental competitors, whose employés are working longer hours at low wages. It is realised that wages in the British engineering industry are already low as compared with those in a great number of industries which require less skill, but under present conditions it is impracticable to increase them, for the position would be made worse, and in the end the workers would suffer from further unemployment. The suggestion that longer hours should be worked is, it is said, not a direct reply to the men's application for higher wages. It is looked upon as a means of re-vivifying the industry, and there is an implication that with a revived industry an application for higher wages could be more favourably considered.

At an earlier stage it was suggested that joint representations should be made to the Government with a view to securing better conditions for Continental workers, to so level up matters as to bring our competitors into line with us so far as labour charges were concerned. This was favourably considered by both sides, but so far as we know the matter has not been pursued further.

In the meantime the employés appear to be determined to resist any lengthening of the working week, and from a position of attack they seem to have reverted to a defence of this principle. Mr. J. T. Brownlie stated in a recent speech that he thought the employers would be persuaded to withdraw their proposal; he intimated, too, that if they did not, the men would have to consider taking an "extraordinary step."

The situation in which both sides find themselves is extremely difficult. It seems to be impossible to forecast the outcome of the negotiations; it is difficult to see how the matter can be satisfactorily ended without some kind of assistance or intervention on the part of the Government.

The Progress of Radio-Telephony.

IT is interesting to watch the rapid progress of radio-telephony in connection with the broadcasting services of this and other countries, due, of course, to its fulfilling a popular need. In a similar way the automobile leapt into favour directly it became available to the public as a source of pleasure and profit, and its development from a primitive stage of unreliability and crudity of design to that of a highly efficient and trustworthy means of transport was phenomenally rapid: but where the motor-car had its following of thousands, the "wireless" can count its millions, for unlike the former, it is a comparatively inexpensive hobby, and appeals to almost every household within range of a transmitting station. The fact that broadcasting has become firmly established as a feature of everyday life is well shown by the attention that is now given to the subject in the lay Press, of which even the most weighty organs now devote many columns a week to critical notes on the programmes of the B.B.C., technical articles written in a popular style by competent authorities, and news relating to the wireless world. It is true that two years ago a section of the Press levelled an attack at the existing system, and misled the public to such an extent that the

resulting slump in the wireless accessories trade brought about the ruin of literally scores of traders; and the lay Press has in the past handicapped the B.B.C. by imposing restrictions on the broadcasting of news, and at one time by withholding its programmes from publication. However, time has its revenges; hardly any paper now dare cut out the programmes, and we shall see the day when the Press discovers that the issue of news by wireless increases the sales of newspapers, just as the manufacture of gramophone records and pianos has been stimulated by the broadcasting of music, and as the theatre managers have been led to realise the advantages of broadcast publicity.

Again, the use of the system for educational purposes is taking practical shape, and the experiments which have been carried on for some weeks at Nottingham, in which the teacher received questions by telephone, and replied to them, both questions and answers being broadcast, have aroused widespread interest. Another highly significant development is the decision of the B.E.S.A., as the outcome of a representative conference convened at the request of the Radio Society of Great Britain, to set up a committee to consider the standardisation of wireless apparatus and components; a specification for ebonite for radio applications had already been taken in hand by the Association, in compliance with a wish expressed by the Ebonite Manufacturers' Association and the Radio Society. The Radio Association, moreover, is developing a scheme for exhibiting signs outside the premises of dealers in reliable wireless equipment, the absence of the sign conveying the information that a dealer is not recognised by the Association. Clearly, things are moving rapidly in the wireless sphere—outside the realm of Imperial communication, in which events appear to march with exceeding deliberation.

The I.M.E.A. Convention.

AFTER the ancient City of Chester last year, the I.M.E.A. has gone almost to the opposite pole of modernity, for although Brighton is no upstart watering-place, it proudly claims to be "up-to-date in every respect"; and the visitors will be able to judge whether Scarborough, their headquarters in 1919, or London-by-the-Sea is the rightful owner of the title of "Queen." The Convention has opened in the course of an exceptionally genial season, and we hope it will close under equally auspicious conditions.

As Mr. W. C. P. Tapper reminded the members in his Presidential address, the first Convention was held at Brighton, under the presidency of Mr. Arthur Wright, who was then the borough electrical engineer; again it visited the town in 1911, when the present head of the Electricity Department, Mr. John Christie, was president; and Mr. Tapper himself was on the electrical staff of the Brighton Corporation at the time of the first Convention. Whilst on this subject it is interesting to note that of the 29 past presidents whose names are inscribed upon the new Collar of Office, twelve have left municipal service, and one of these, unfortunately, has finished his course.

The popularity of the Convention now current may be judged from the fact that no fewer than 810 members, delegates, and visitors are taking part in it. The progress of 30 years is indicated by the advance of the output of municipal undertakings from 39 to nearly 3,000 million kWh per annum, and of the capital expenditure from four to 154 millions sterling; but Mr. Tapper holds that with the development of railway electrification and of the domestic demand, the use of electricity will expand out of all comparison with these figures during the next 30 years.

Paying a well-earned tribute to the self-sacrificing devotion of the Electricity Commissioners, the President turned to the problem of London's electricity supply, and showed that in a report which he submitted to the London County Council in 1912, which came before the Board of Trade Committee whose report was followed by the Act of 1919, he had advocated the unification of the London systems, standardisation of voltage and frequency, and the development of a few large generating stations with water facilities, linked together, and giving bulk supply to the remaining stations. He also proposed the ultimate erection of two large stations on the river, the centralisation of generation, with the existing authorised undertakers as distributors, and the adoption of a sliding scale of tariffs and dividends, besides outlining a national scheme which resembles that set out in the Act of 1919. He is to be congratulated upon seeing his far-sighted conclusions in the course of fulfilment.

Mr. Tapper utters a timely plea on behalf of members of staffs who may suffer financially from the consequences of recent legislation, urging that compensation on a more generous scale should have been provided, and that if that had been done, the path of the Commissioners would have been easier; there can be no doubt that opposition to co-operative schemes involving the substitution of bulk supply for local generation, or other changes suggestive of reductions of staff, has been fostered by such personal considerations. The men who, as the President says, have given the best years of their lives to the industry are entitled to the just reward of their labours, and if the existing Acts do not adequately meet the case, the opportunity should be seized when the new Electricity Supply Bill is introduced to remove all doubts upon this score by securing the adoption of suitable clauses.

Perhaps the most important item in the Presidential address is a reference to the determination of the Council of the I.M.E.A. to exert every effort to obtain "full hire-purchase, selling, and wiring powers" for all municipal undertakings. On this question we have always maintained that the electrical contractors should be afforded full opportunity to provide the necessary service, and should be protected from "rate-aided competition." We have, however, indicated in no uncertain terms that if the contractors failed to meet this urgent want, in our opinion there would be no alternative to the bestowal of these powers upon the electricity supply undertakers.

We note with cordial approval Mr. Tapper's attitude towards the bleeding of a supply undertaking for the purpose of rate relief, a practice which we have condemned ever since its initiation as unjust to the consumers and a heavy brake on the progress of the undertaking. Parliament has set its face against the practice in individual cases, and it is high time that a general edict should be issued relieving the industry wholly from this unjustifiable burden.

Although the President's address was commendably brief, it will be seen that it touched upon some interesting and highly controversial topics of which more will be heard in the near future.

The German Stinnes Group.

THE name of the Siemens-Rhein-Elbe-Schuckert Union has been brought into connection with the firm of Hugo Stinnes and the Stinnes concern during the course of recent discussion in the German newspapers respecting developments within the firm of Stinnes. Dr. C. F. von Siemens is now reported to have stated that the Siemens and Halske Company, the Deutsch-Luxemburg Bergwerks und Hutten, the Gelsenkirchen Bergwerks Gesellschaft, and the Electricity Works Company (late Schuckert & Co.), which are united in the community of interests of the Siemens-Rhein-Elbe-Schuckert Union, have never had any economic or financial connection with, or had any dependency upon, the firm of Hugo Stinnes or the Stinnes concern. The firm of Stinnes is solely a shareholder in the one or the other company, with the rights of any other shareholder, without, however, any obligations having existed, or being able to arise, for the companies in question from this ownership of shares. Nor, it is stated, is there any close connection with the Austrian undertakings mentioned in some newspaper reports. From the present statements it appears, then, that the Union, or any one of its own companies or subsidiary companies, can in no way be brought into connection with the events in the Stinnes concern.

D

The Institution of Electrical Engineers.

Summer Meeting at the South-Midland Centre.

(*Continued from page* 940.)

On Wednesday morning, June 10th, Worcestershire was entered by the Bristol road through the suburbs of Selly Oak and Northfield to Longbridge, where the works of the Austin Motor Co., Ltd., claimed to be the largest motor manufactory in the British Empire, were inspected. The works are situated in a rural neighbourhood near the foot of the Lickey Hills, where the

Fig. 5.—Engine Erecting Bay, Austin Works.

city of Birmingham has its most extensive park. Most of the buildings are modern, the actual factory area being 62 acres; the annual output is about 16,000 cars produced by 8,000 persons, but the shops can provide employment for 12,000 hands per shift, and are divided into three sections: The south works (53 acres) include the pre-war establishment, while the west and north works (14 and 16 acres respectively) were erected in 1916-17. The total area of their sites, with the testing track and playing fields, is 220 acres, and the single-storey construction is adopted with saw-tooth north lights. The continuous method of production is in use, as indicated in figs. 5 and 6, which show the engine-erecting section and the chassis-assembling shop respectively; fig. 7 is a view of the crank-case section of the machine shed, while fig. 8 shows a 400-ton press electrically driven, as are the whole of the works.

The company has always generated its own electricity, and the power station was fully described in our issue of February 13th, 1920; it is equipped with three 1,500-kW B.T.-H., 3-phase, 550-volt, 50-cycle machines.

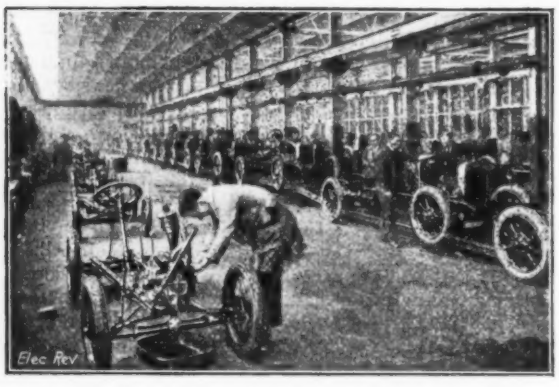


Fig. 6.—Chassis Assembly Section, Austin Works.

There are some 400 electric motors in the various shops, driving many of the machines individually, and the remainder by means of line shafting aggregating nearly three miles. Electric light is used throughout, compressed air is available, and provision is also made for hydraulic power in many of the shops. The boiler house contains 12 boilers, with a total evaporating capacity of 80,000 lb. per hour, the fuel and ashes being mechanically handled, and each boiler has an automatic stoker. The original south power house is equipped with two Belliss and Morcom sets of 150-kW capacity, fed with steam from independent boilers.

An alternative visit was to one of the rectifier sub-stations which have been installed by the Birmingham Corporation for converting 25-cycle a.c. into d.c., as described in our issue of November 28th, 1924. The sub-station visited at Longbridge is one of three traction stations, each equipped with eight glass rectifier bulbs, each giving 150 amperes at 550 volts. Each pair is supplied from one transformer, making use of the six phases of the star-wound, 3-phase secondary winding; a complete unit of 660-kW capacity therefore consists of four transformers, each feeding two bulbs in parallel. The control is semi-automatic, the main automatic features being incorporated in the outgoing feeder switchgear. This is one of two specially interesting features connected with the use of electricity in the district, distribution for domestic purposes in the outlying residential areas being largely carried out in the form of direct current in preference to the 25-cycle a.c. The other is the successful experiment with heavy railless traction that was initiated when the seriously deteriorated tramway track on a busy suburban route was

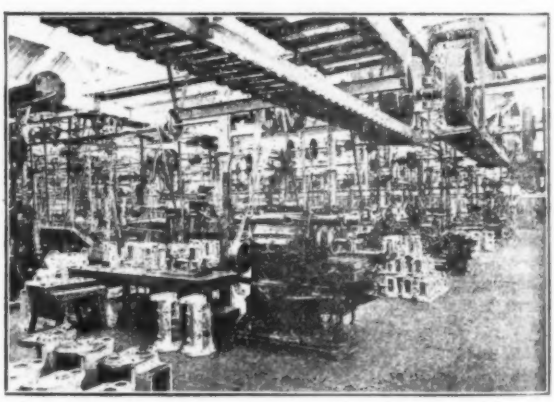


Fig. 7.—Crank-case Machine Shop, Austin Works.

removed. Double-deck trolley cars, resembling ordinary tramcars in outward appearance, are used, and the project has justified expectations as the following table will indicate (the petrol vehicles including both one- and two-man 'buses):—

	Tramcars.	Petrol 'buses.	Trolley 'buses.
Revenue per mile run	18.2d.	15.6d.	18d.
Cost per mile run ...	12.7d.	11.9d.	12.15d.
Passengers carried ...	214,338,365	16,524,239	4,924,[illegible]38

The more evenly-graded route across the Lickey Hills was then taken *via* Catshill, where a typical example of the overhead distribution system of the Shropshire, &c., Power Co. was seen, through Bromsgrove to Droitwich, where a halt was made for an inspection of the brine baths and for luncheon as the guests of the Power Co. The drive continued to Holt Fleet whence an hour's steamer trip up the River Severn brought the party to Stourport, a small industrial town at the junction of the river and the canal, for an inspection of the capital generating station of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. The station, which was sanctioned in September, 1922, will have an ultimate capacity of 200,000 kW; it is hoped to inaugurate the first portion in November next, comprising two B.T.-H. 15,000-kW turbo-generators and a 750-kW house-service set, all the condensing plant

for which has been manufactured by Messrs. Cole, Marchent and Morley, Ltd. Each condenser is provided with two circulating-water pumps, two vertical extraction pumps, and two sets of C. M. & M.-Delas air extractors, incorporating boiler feed-water heaters and de-aëration plant. Each condenser weighs 60 tons, will operate with a vacuum of 29 in., and needs 1,050,000 gal. of cooling water per hour—just about equal to the total town water supply at Bradford. The company has four other power stations in operation, and a big feature of its operations during the last two or three years has been the extension of its distributing network into the more rural portions of its district in Worcestershire, in which connection the company has probably done more than any other undertaking in this country. After tea in the grounds of the Arley Hotel, the return drive was *via* the carpet-making town of Kidderminster, skirting the Black Country and entering Birmingham through the fashionable suburb of Edgbaston.

In the evening a dance and conversazione were given at Bournbrook by the Council and Senate of the University, the visitors being received by the Vice-Chancellor (Sir Gilbert Barling, Bart., C.B., C.B.E.), Miss Barling, and the Principal of the University. A short whist drive had been arranged for those who did not wish to dance, and the engineering laboratories were thrown open for inspection. It may be recalled that the foundation in 1875 by Sir Joseph Mason of the college that bears his name inaugurated university education in Birmingham. Opened in 1880, Mason College was absorbed in the University upon its incorporation in 1900. The local I.E.E. Centre meets in the original buildings in the city, but most of the science departments are housed in the new Byzantine buildings at Edgbaston. The Electrical Engineering Department naturally claimed most attention; it was originated by the late Dr. Gisbert Kapp, being now presided over by Prof. C. Cramp, D.Sc., M.I.E.E., and local students are fortunate in having access to such commodious laboratories and the use of complete experimental and testing equipment. Some of the machines are of special interest, particularly those fitted with magnetic friction clutches, and the large mirror photometer for testing high-c.p. lamps is said to be the only one of its kind in this country. The Hewittic Electric Co. has received an order for 44-kW standard mercury-arc equipment

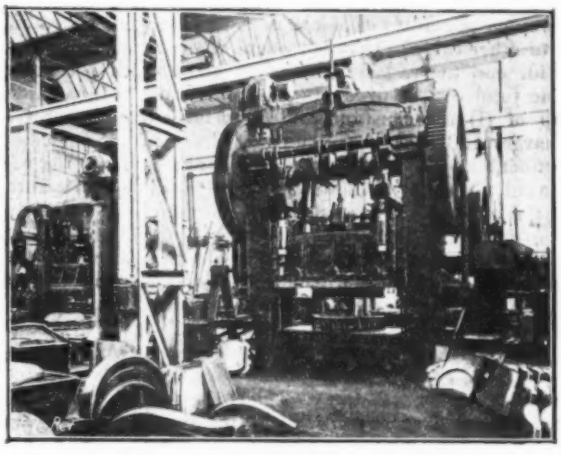


Fig. 8.—A 400-ton Press, Austin Works.

for the University, and the apparatus is expected to be installed in September. It is to be used regularly for supplying part of the direct current required for laboratory work, and will also be available for experimental and research purposes. A collection of historical machines is also being made.

(To be continued.)

Charges for Electricity.

By THOMAS CARTER, M.Inst.C.E., M.I.E.E.

A short leader appeared under this heading in the Electrical Review of November 7th, 1924, drawing attention to the observations on the same subject in the report of the Electricity Commissioners for the year 1923-1924. The point specially stressed was that an acceptable basis for the fixed charge in a multi-part tariff was still lacking, and the question at the end of the leader, left unanswered, though indicated as somehow answerable, was: What, then, should be the basis of an acceptable two-part tariff? Until some acceptable basis is arrived at, the prospects of a general change from a flat rate are not bright; and yet the change is desirable.

Some time before the appearance of the short leader, I had had definite evidence from four separate consumers, differing in their circumstances, and in different parts of the country, that charges based on two-part tariffs in their ordinary form are very much disliked. The reason, as far as I can discover, is that the accounts are made up showing far too much detail, and the consumer, seeing many items set down, begins to wonder what each of them means. Sometimes he knows just enough about the matter to make him think he can get at the sense of the thing for himself, but often enough he does not succeed completely; if, on the other hand, he does not know anything about it, why put before him details that are meaningless to him? The part of the charge based on the kW demand seems to suggest to him that not all of what he pays is in respect of what he consumes. If I go into a restaurant for dinner, I do not expect to see a bill in the window stating that I may have eight courses for one shilling, and to be met at the door by an overpowering fellow who demands nine shillings before he allows me to enter. No matter how the bill is made up, I shall be quite certain that my dinner has cost me ten shillings; and that is really the main point. In the same way the serving out of units of electrical energy must render the consumer liable for full payment of the whole cost, both direct and indirect, of what he has taken. It is therefore really rather futile to split up the bill into so much for kW demand and so much for units consumed. It would be vastly better merely to send in an account for units, as measured on a straightforward meter, at an inclusive price per unit, and let that be all.

If a supply undertaking could work always at full load, putting out electricity at a constant rate, using a battery to smooth out hollows and peaks, just as a gas company uses its gasholders, the problem of the tariff would be a very easy one to deal with: a flat rate, with perhaps a slowly increasing discount for increasing quantities taken, would be a fair arrangement. But because electricity supply is carried on in a way entirely different from this, the cost of the supply is made up in a far less simple way. The station must cope with the demand of each moment by means of its running machinery; there can be no provision for to-morrow's demand to-day. In order to have a supply at all, capital is required to pay for the necessary buildings, plant, and distributing system; and when the supply is being given, there is a continuous expenditure because it is necessary to provide without intermission the means for its maintenance. The cost of the supply is thus made up of (*a*) the cost of financing the capital that has been expended, so as to provide for such charges as interest, loan repayment, depreciation, reserve, profit, and the like; and (*b*) the cost of actually producing in the station and conveying to the whole body of consumers the energy they require. The cost under (*a*) is

fixed, no matter how much or how little the undertaking produces; the cost under (*b*) is made up of rent, rates, taxes, management, salaries, wages, cost of coal, cost of losses in distribution, cost of electricity used in the station, and so on. Of the cost under (*b*), some is independent of the number of units sold, and some is proportional to it; a definite quantity of coal must be fed to the boiler fires, for example, before any units are produced at all, while the remainder is expressible as so much per unit; some expenses of management, rates, and other things are independent of the number of units sold, and the rest may be taken at so much per unit. The total cost of producing the units sold is thus made up of (i) the constant and invariable cost of capital charges and such of the running charges as are not dependent on the amount of the output; and (ii) the remainder of the running charges, which is proportional to the number of units sold, and is therefore definitely convertible into a cost per unit sold. I do not say that it is a simple matter to separate out these two costs; it is indeed exceedingly difficult; but the fact remains that they exist. On the assumption that provision has been made for profit in computing the fixed part of the cost, the undertaking will be prosperous if its revenue equals the sum of the two parts of the cost, that is, the revenue should be $C+KN/240$, where C is the amount, in £, of the annual fixed charges, including the invariable part of the running charges; K is the value per unit, in pence, of the part of the running charges proportional to units sold; and N is the number of units sold per annum. The sole source of revenue is the consumers, to whom the product of the undertaking is sold, and the question at issue is how the total amount is to be apportioned amongst them. The relation between the two amounts C and $KN/240$ will be different for different undertakings, and for any one undertaking it may vary from time to time for many reasons. But the tariff of an undertaking, once fixed, cannot be varied at short intervals, and ought not to vary at all except for some very good reason, such as a considerable alteration in the cost of coal or in rates of wages, or some entire change in general circumstances; it must therefore be determined once and for all, after very careful investigation, with due regard to all the facts, and in such a way that year by year the revenue will amount to the necessary sum. (In some tariffs there are apparent seasonal changes, such as, in domestic supply, a greater "fixed" charge in some quarters than in others; but these devices doubtless deceive no one as to their real meaning.)

The problem, then, is to devise a tariff that will produce from all the consumers the required revenue in such a way that each consumer contributes a reasonably fair share in return for what he gets, as far as that share can be conveniently ascertained with accuracy. As will be seen, the amount paid by each consumer should depend on the demand he makes on the machinery in the station, on the number of units he takes, and on his circumstances as a consumer relatively to other consumers. Since the questions that were referred to at the outset arose last year, I have been trying to devise some scheme that will remove the objections to the multi-part bill and will yet preserve the essential features of the fair scheme; the result is set down here. Recently two papers on the subject have been read and discussed, and have presumably led the matter nearer to whatever is to be its final outcome; and although some of what I have in mind necessarily overlaps those and other papers and articles, there may be enough difference between my final suggestion and theirs to make mine worth putting forward for consideration with the rest. I say quite frankly that I do this as an inquirer and not as an expert.

A very careful analysis may be made of the circumstances of typical consumers, some things being assumed for the purpose; but no analysis can take everything into account, and often the things that cannot be counted matter most. A group of consumers may come on just in time to necessitate the starting up and running at light load of an additional generator; they may do this on some days, and not on others; they may take their maximum supply at one time on one day and at another on another; their requirements may change altogether from period to period during the year; and so on. Variations unforeseeable in kind and uncountable in number must occur; and the only solution that I can see is to get down to something that will not depart from fairness more than is avoidable, and to trust that, for the rest, the incomputable things will average themselves out. If my scheme is feasible, it will be possible to draw up a consumer's bill with only one item in it, namely, so many units at so much per unit, the price per unit—and this is the important point—being a maximum price reduced by a discount dependent in each case on the relation between the consumer's consumption and his demand. This would do away with the appearance of charging for so many units at a high rate, and for the rest at a low rate; or of charging so much per kW demanded, and so much in addition per unit; or of charging something based on the rateable value of premises, or on floor area, or on the size of a domestic consumer's family (why not?), and again so much in addition per unit.

Each consumer's installation requires that a definite amount of plant shall be in readiness in the supply station. It need not be equal in capacity to the consumer's maximum demand if the diversity factor of the system, or of the part of it considered, is greater than unity; but it bears some ascertainable relation to that maximum demand. Hence maximum demand enters in some way into the financial relation of the consumer to the undertaking. That is one factor: the other is the number of units taken by the consumer in a given period. The plant he needs costs a definite sum to install, and the units he uses cost a definite amount per unit to produce. Out of this arises the ordinary two-part tariff in its many varieties; what I have to suggest is a disguising of the two-part tariff so that it looks like a flat-rate tariff with discounts. It seems to me much better, instead of charging so much per unit plus something, and sometimes plus something and something and something more, to charge a higher amount per unit and deduct something from it. The ultimate result is exactly the same; but consumers are human beings, with the usual characteristics of ordinary men. Two consumers taking the same number of units, but having different maximum demands, should pay different amounts because of the different costs to the undertaking of their different requirements in plant; in my suggested system this would be taken care of by a varying discount; and if any question is raised (explanations should not be given unless they are asked for, and not always then; on the whole there have been far too many explanations to untechnical people) it may be said in reply that a consumer who makes little use of the plant must still pay for it. A cottage in the country costs something to keep up all the year round, although it is inhabited for only a few weeks in the summer (or, at least, in July or August). The suggested flat-rate-with-discount tariff ought to be applicable to all consumers alike. Nothing more would be required than to ascertain (*a*) by an ordinary straightforward meter how many units had been taken in a given time, and (*b*) what the maximum demand in kW had been during the period, or during the year including the period, if the period is shorter than a year. For large consumers a maximum demand indicator of some kind would be installed, just as at present; for small consumers the maximum demand would have to be estimated in some way. (In this proposal my scheme is similar to that of one of the papers recently read, and I believe that it is the best way to avoid the impossible expense of providing demand indicators for every single consumer. The further proposal is made in the paper referred to that consumers should be penalised if they exceed their maximum demand: but this is probably one of the things that may be allowed to average themselves out, and my scheme does not propose that any action of that kind should be taken. If the estimation is made carefully, and if, occasionally, the curve of consumption is checked by means of a recording ammeter in important cases, the general requirements should be fairly enough met.)

If the circumstances of every consumer were identical, there would be a flat-rate charge, with or without small discounts, of $c/N + \kappa/240$ pounds per unit. Those, however, who use the plant less than the average must pay more than this, while those who use it more than the average will justly pay less. The use that is made of the plant is measured by the ratio of the units actually consumed to the units that would have been consumed had the plant reserved for the consumer worked all the time at an output equal to the consumer's maximum demand; that is, by a load factor. If, then, the consumer's load factor is less than the general load factor, he pays a higher rate per unit than the average; if more, a lower rate. In order to arrive at a charge that will be as nearly as possible correct, the maximum demand occurring in a year must be taken as the basis of the computation, because it is the permanent maximum demand that determines the amount of plant that must be kept, and a shorter period than a year might include a seasonal departure from the true maximum. A station plant is not of the kind that dies away and grows again periodically. If a shorter period than one year were adopted between two resettings of the indicator, the only logical way of dealing with the revenue would be correspondingly to revise the tariff periodically; yearly resetting avoids this, because then the demand indicator fulfils its essential purpose.

(*To be concluded.*)

Welding—The Filling-in and Putting-on Tool.

By W. R. NEEDHAM.

FORMERLY classed with such potent mirth-provokers as the fabulous glass hammer, the putting-on tool has been the machinist's standing jest. Even while he laughed, however, he would have given much could he only emulate the pattern-maker who is able to enlarge his pattern by strips added to it. As the alchemist desired the philosopher's stone, so the machine-tool operator longed for that which should help him to replace the deficit caused by the too-deep cut.

Like many another thing once deemed impossible of attainment, the equivalent of the putting-on tool is a practical proposition. It has been in vogue for many years; and it is coming more and more into its own. The modern art of welding, born perhaps a generation ago, is still a child; but it is a lusty youngster and full of vim. The future is bright with promise. What has to be kept in mind, however, is that present knowledge, present attainments, and present deftness are immature. Thus, the results sometimes obtained are apt to disappoint those whose expectations run ahead of their experience. Patience, and careful attention to detailed instructions from those who are really familiar with the technique and expert in the practice, are prime essentials. Where such attention is given and such care exercised, a fair amount of success should be achieved in the ordinary workshop. With practice will come reasonable and increasing proficiency. Messrs. Cammell, Laird & Co., Ltd.,* when building their all-welded motor ship *Fullagar*, which was put into service about the autumn of 1920, found that it took an average of approximately two months' time to train men as welders. While some men naturally displayed greater aptitude than did others, it was also proved that, in general, once a man became proficient, his work continued to give satisfaction. Again, as the experts prosecute their researches, improvements in methods and material may be expected to yield substantial benefits in results.

One direction where the explorers in this field have still much ground which awaits axe, pick, and spade, is in the matter of the welding of cast iron. A good start has been made, and fair progress recorded. Better things are in prospect. Little imagination is needed to picture the importance of this desirable extension to a most promising territory. The ground already won is only less valuable than that which is yet to be conquered. It is one of the richest prizes in the whole realm of engineering.

For certain classes of work, the welding of cast iron, if only it be satisfactorily negotiated, effects a marked saving in cost *per se*. The economy is usually greatest in time, rather than in material or labour. This time saving in itself may represent a sterling or dollar equivalent often materially in excess of the net gain in cost, considered apart. The usual cases are, of course, the familiar instances of repair work. Other examples one might name have reference to the local building up of material, as distinct from the repairing of cracks or breaches, of putting-on rather than filling-in. In either case a member is saved from the scrap-heap. Thus, a vital part of a machine may give out or break down under vibration or accidental impact. The vibration or impact may be the occasion of the fracture, a blow hole or other local weakness the cause of it. Consider now the alternatives which confront the works manager or responsible engineer. He can dismantle such parts of the machine as will enable him to remove the damaged casting (assuming it to be such) to the foundry; there it is decided whether the process known as "burning-in" is feasible, or whether a new casting is preferable. Whichever method be favoured, the repaired or new casting must be delivered to the machine site, then mounted in place, and, finally, the various other parts involved re-assembled. Where a new casting is in question, there will be in all probability the intermediary operations of marking-out and machining in the machine shop. These various processes may well occupy a full week's time. Expenses, though heavy, will generally represent the least part of the loss involved. *The major item of expense will be the cessation of most, if not all, of the work for which the machine catered.* Even where the urgent work be diverted to other machines, under anything like normal conditions, there is an equivalent loss not greatly less than that directly contemplated.

Another possible alternative, assuming that neither strength nor stiffness is in question, is the tying together of the portions on either side of the fracture by means of stout bars securely bolted in place. This will, in most cases, also necessitate a removal of the damaged casting to the machine shop for planing or slotting, and drilling. Then the connecting bars will have to be machined to suit the necessary contours, probably after rough forging to approximate size and shape. This method likewise involves a certain amount of dismantling of contiguous and affected parts, and their reassembly. While considerably quicker than the previous alternative, even here two or three days might easily be expended over the job. Where vibrational disturbance has been experienced, that should be sufficient to give pause ere choosing the present method.

* The paper entitled "Electric Welding," read before Inst. Mech. Engs., February 17th, 1922, by A. T. Wall, naval architect to Messrs. Cammell Laird.

The third, and in several instances, eminently desirable procedure, is the welding of the breach. This can often be thoroughly recommended where the breakdown has not affected a machined portion of the surface. It is well known that the metal of the weld, and that adjacent to it, tends towards the white rather than the grey or mottled form of iron, the carbon being mostly in the combined, not the separated, state. This means, of course, that the weld and its environs are extremely difficult to machine. Where, however, such a surface is not involved, matters are simplified very much indeed. It not infrequently happens that the welding can be done on site without any dismantling operations being necessary at all. Where parts have to be removed, they are relatively few, and the work is simple by comparison with what obtains when the injured casting has itself to be taken away. The whole job may be put to rights within twenty-four hours. Where this is possible the all-round economy is obvious. There is direct saving in material, time, and labour, and more marked, if indirect, saving in the time otherwise lost on the normal products for which the machine functions.

It may be added that the weld itself is more often than not the strongest part, while the casting in the vicinity of the weld is usually fifteen to twenty per cent. weaker than normal. Where, however, an eighty per cent. normal strength is well above the approved factor of safety little anxiety need be felt.

Should there be ground for believing that resonance occurs, the matter would demand very serious attention. In that case, however, the original item in any event would have been equally in question. Such considerations as the method of support, the nature of various parts of the environment and especially the nature and disposition of the fundamental support, require the closest investigation.

As a putting-on tool, also, the art of welding has salved many an otherwise derelict, but costly, forging or casting. Gear teeth have been added to damaged pinions and spurs, worn or under-sized journals have been made up to the stipulated diameter, lugs and bosses have been built upon the site of earlier ruins; and in many ways, and to answer many purposes, this surgery and grafting of materials has abundantly justified reasonable expectations.

It is probably well to emphasise how necessary it is in welding work that, at least until proficiency has been attained, those who undertake the job should proceed slowly. The best men should be put to the task—men who understand something of the real inwardness of the matter, and who are, above all else, familiar with the technique and facile in the art. It is worse than useless to assign such work to a novice, excepting his efforts be made under the closest supervision of an expert. Really important work should be entrusted to operators who have proved themselves. Those who trust to luck in these matters are apt to blame it, and to condemn a good process out of hand, if the results obtained turn out unsatisfactorily. Ignorance—that, and impatience—are often responsible for such failures as occur. Sometimes the method is not persevered with. It can only be judged impartially after a fair and intelligent trial has been made.

Where there is no one to whom welding work can be confidently entrusted, it is advisable, in the first instance, to secure expert outside assistance and tutorage. Then those who are later to carry on this fruitful enterprise can be expected to do so with understanding and increasing skill.

By pre-heating a casting ere welding be undertaken, especially if means be taken to retard the normal rate of cooling, a softer weld, and one more readily machineable, should be obtained. This is sometimes done. The great objection to welding, on the grounds of machining difficulties, is being overcome; thus, in the case of cast iron, the Secretary of the American Bureau of Welding states*: "Now electrodes have been developed for arc welding cast iron, including a special copper-nickel alloy wire. . . . Resultant welds may be tooled as easily as carbon steel." This alloy electrode facilitates the welding of cast iron without the use of studs and without annealing.

Whether autogenous or arc welding be in question, one most important consideration, applicable alike to each, is the provision to be made to accommodate the expansion and contraction of the metal involved. Thus preheating is usually in vogue as an approximate means to regulation or control. This preheating may be complete or local.

The oxides are the bug-bear; how to eliminate oxide is the problem. In the case of arc welding it is distinctly preferable to obtain electrodes from reliable manufacturers which they themselves recommend for the particular work in question. Many makers are specialists, and can provide electrodes which effectively clean adjacent surfaces, largely eliminate oxidation of metal deposited, and are readily amenable to control. Mr. Strawson, contributing to the discussion on Mr. constant and that the speed of operation be, as nearly been referred to, lays great stress upon the need for adequate current supply, that pressure be reasonably constant and that the speed of operation be, as nearly as possible, that which experience has proved most efficient for the particular class of work undertaken. He strongly advocates that the available supply of current shall more than satisfy the *maximum* demands of all the welding work which may be in requisition at any one time. The voltage should be maintained as nearly constant as possible, but not too high. The danger is, that when welding with a long and flaming arc, it is difficult to control the then too fluid metal. In the result, oxides would form, and the weld would be hard and brittle. The desideratum is the shortest arc which will ensure an even flow of metal. Mr. Roberts, another contributor to the same discussion, expressed the utmost confidence in the strength of welds effected by the electric arc. He cut many such welds open, and took micro photographs and found that the welds were sound. The ultimate tensile strength was invariably round about 28 tons per square inch in mild steel. He regarded the fairly widespread scepticism with regard to strength as having arisen by reason of the slipshod procedure tolerated or overlooked in many directions. The metal deposited should be as like to the adjoining metal as possible. He instanced work done at the Quasi-arc Works, whose welds, tested by Lloyd's, had withstood 200,000 alternations of stress ere fracture occurred. Then, when the metal did break down, it was outside the weld.

Mr. A. L. Price, of the Franklin Machine and Steam Boiler Works, addressing the Metropolitan Section of the American Welding Society (1921 or 1922), compares results as obtained by using metallic and carbon electrodes, respectively. Work can be done much quicker with the carbon electrode, but it also demands a higher degree of skill in the operator. In welding a seam in steel, it is possible almost to quadruple the speed taken when using the metallic electrode. On the other hand, however, the joint so obtained is neither so strong nor so satisfactory as that negotiated by means of the metallic electrode.

In the case of autogenous welding, much depends upon the skill of the operator in maintaining the crucial "neutral flame." He requires what almost amounts to a new sense if he would keep his blowpipe functioning as consistently as an admittedly imperfect instrument can. He may easily—as many, in fact, do—be unwittingly retarding the acetylene flow, facilitating an excess of oxygen. Thus there is present an oxidising instead of a neutral flame. The right kind of welder, however, develops this welding sense—an acquired characteristic.

Mr. E. Andrewst gives particulars of economies effected by the welding salvage of railway work. The procedure followed is to (*a*) clean the parts affected;

* "Recent Developments in Welding Methods." European Edition of *American Machinist*, March 8th, 1924, page 79.

† *American Machinist* (European Edition), October 18th, 1924, p. 98E.

(*b*) scarve joints by means of oxy-cutting blowpipe to 45 deg. angle; (*c*) remove all oxidised metal; (*d*) assemble work, allowing for expansion and contraction; (*e*) weld, using metal most suitable for the particular job.

He recommends aluminium alloy rod for aluminium; iron for iron; steel for steel; Tobin bronze for cast and malleable cast iron.

Among the items reclaimed during six months, figure principally 33 wrought iron and 12 cast steel locomotive engine frames. Cracks varying in length from $2\frac{3}{4}$ inches to 16 inches were welded up.

J. H. Booer, B.Sc., F.C.S.,* prefers the oxy-acetylene process for cast iron, but states also that arc welding with a graphite electrode gives good results. Mild steel he regards as readily amenable to electric or oxy-acetylene treatment. Copper and the bronzes are good subjects for the welder's art; but aluminium is probably the toughest proposition he need expect to meet.

Mr. Booer's paper is packed with information—much of it of intensely practical value. The reader would do well to peruse the whole of it. He emphasises the necessity for preventing oxidation. The whole strength and quality of the weld, and its vicinity, depend upon the degree of immunity attained. The problem is approached from two directions. There is the chemical attack, which, through the medium of suitable reducing agents, decomposes what oxide may be formed; and there is the physical defence, whereby the welding rod is protected, the deposited metal is safeguarded, and, finally, most, if not all, the remaining oxide traces are dissolved.

For autogenous welding of cast iron, recent research has produced special composition rods which are preferable to even the well-proved silicated rods. Thus, specially interesting is a rod containing such a proportion of titanium as shall eliminate internal oxidation of iron and carbon alike. Flux ingredients of sodium carbonate, borax, and silica form a coating which satisfactorily protects the rod. The flux reaction yields a slag which effectively dissolves iron oxide.

For electric welding of mild steel he recommends the use of a protective flux, which should melt at the same rate as the electrode, contain a reducing agent, and form a suitable slag. He states also that it is impossible to eliminate all oxidation by unassisted use of the oxy-acetylene blowpipe. Thus, for autogenous welded steel, as well as iron, he deems it necessary to provide some form of reducing agent. While numerous such media are in vogue in one form or another, whether as powder, or alloyed with the welding wire, he personally favours a liquid de-oxidising material for the welding of steel. He instances one such liquid which is sold in cans of about one and two pints' capacity, respectively. It is used in connection with welding wire which does not contain de-oxidising elements. In practice it is applied with a brush to weld edges of the work and the welding wire itself prior to the welding operation. Then, later, at the high temperature of the flame, it slags the oxide, keeps clean the surfaces, and thus effectively prevents the formation of oxides. It is recommended for repair work, for the welding of sheet metal, thick material, and castings. Mr. Booer urges users to accept only such fluxes as have been prepared by expert makers.

As an example of recent welding practice, reference might be made to drastic repairs upon the cast steel stern frame of the U.S. s.s. *Saratoga*. Here a Thermit weld knit together a huge crack of about nine feet in length. The paper† describing this salvage work contains many examples of important repairs, and is illustrated by many excellent photographs. Another instance one might mention is that of electric welding as applied, not to repair work, but to electric motor manufacture. The Lincoln Electric Co. (U.S.A.), in a recent design (*vide Electrical World*, August 30th, 1924, page 423) welds the copper rods or windings to the short-circuiting rings; the fans to the rotor; and the frame feet, which are drop forgings, to the standard angle steel rings which constitute the frame. These angle steel rings are ordinary angles rolled to circular shape. Their abutting ends as so brought together are also welded.

Yet another case is the electric welding of stator connections for large alternators. The A.1 Electric Welding Appliances Co. has an electric welder, of which a description and illustrations appeared in *Engineering* December 5th, 1924, page 764. The illustration, which is very clear, shows the welder *in situ* upon the stator winding of an alternator at the Stafford works of Messrs. The English Electric Co., Ltd.

One of the principal objections to welding has been the necessity for relying so much upon the operator. The human factor looms large; and to err is human. Many welders, however, are remarkably reliable and expert. As an indication of further development, however, it may be pointed out that certain strides have been made in the direction of automatic control. One such example is the Cutler-Marsden welder, described and illustrated in the ELECTRICAL REVIEW, December 12th, 1924, page 917. This automatic straddles up a seam, rather like a travelling sewing machine would do. The speed claimed for the invention is some five to seven times in excess of normal hand working. These machines have welded miles of steel piping in Australia.

A great future awaits the science of welding and the art of the welder, and the automatic machine will doubtless come more and more into vogue. It is impossible, however, that it will utterly oust the hand welder. His skill and his readiness to respond to improvements in methods and processes will always prove to be prime factors in the making of that future.

For filling-in and putting-on metals, welding is the tool *par excellence*.

The British Association.—Arrangements are well in hand for the 95th annual meeting of the British Association for the Advancement of Science which is to be held at Southampton from August 26th to September 2nd. As previously stated, this year's president is Professor Horace Lamb Sc.D., D.Sc., LL.D., F.R.S., and the president of the Engineering Section is Sir Archibald Denny, Bart. The latter will deal in his presidential address with "Fifty Years' Evolution in Naval Architecture and Marine Engineering." Miss Lynda Grier, the president of the Economics Section, will take as her subject "The Meaning of Wages." Among the joint discussions which have been arranged are one between the Chemical and Engineering Sections on "The Ignition of Gases," and another between the Engineering and Economics Sections on "Transport Problems," which will occupy two sessions. As usual a number of excursions and visits to local places of interest are being planned. These include an inspection of the works of Messrs. John I. Thornycroft & Co., and the Pirelli Cable Works.

Further particulars of the meeting can be obtained from the Secretary, Mr. W. J. Howarth, O.B.E., M.A., Burlington House, W.1.

Cast-iron Research.—The Council of the British Cast-Iron Research Association has recently extended the research programme by arranging for an investigation of the influence of silicon, manganese, and phosphorus on the formation of graphite in cast iron, to be conducted by Mr. M. L. Becker, M.Sc., at the University of Manchester, under the supervision of Prof. F. C. Thompson, and for an investigation to be commenced at the National Physical Laboratory under the supervision of Dr. W. Rosenhain, F.R.S., into the alloy systems iron-silicon, iron-manganese, iron-phosphorus in the presence of carbon over the range usually associated with cast iron. It is anticipated that these fundamental investigations will yield information of great value in connection with other investigations in hand. At a recent meeting of members it was decided that the maximum annual subscription should be reduced to 100 guineas per annum. The minimum is at present five guineas per annum for the smallest foundries. The director and consultant of the Association are now visiting Continental laboratories and works for the purpose of examining recent foundry developments, particularly in Germany.

---

* "The Chemical Aspects of Welding." Paper before Inst. Welding Engineers, February 12th, 1924. (Also reported in *Engineering*, February 15th, 1924, page 221.)

† "The Manufacture and Repair of Heavy Steel Castings." Paper by Hugo G. Frear, before American Society Naval Architects and Marine Engineers, New York, November 7th, 1923. Abstracted *Engineering*, December 7th and 14th, 1923, pp. 735 and 757.

This Puzzling Power Factor.

By "STAN DARD."

As one moves about in industrial areas one cannot help being impressed with two facts. The first is that conditions in general are particularly favouring the existence of low power-factors. The industrial depression has a direct bearing upon this, because the immediate effects are power transformers on "no load" (or insignificant loads like a few lamps); machinery often running idle or with small input; and the continued use of inefficient old motors, &c., which, under more promising conditions, would be scrapped and replaced by up-to-date plant.

The second fact that one notes is the steady growth of interest shown in power factor. It may be that, under existing circumstances, this growing interest in the subject cannot always result in the practical outcome which one would like. Still, it is all to the good. One fears, though, that in many cases the local electrician can never hope really to get to grips with power factor—and this from sheer inability. His experience and knowledge are not "up to it." Often he is a fitter or the like who has been put in charge of the electrical apparatus. (In this connection the suggestion from H.M. Electrical Inspector of Mines anent the technical status of electrical men is not without its point: he urges that care must be exercised that such men are capable of undertaking their particular jobs.)

I suppose that one of the easiest forms of wit is ridicule of the ignoramus. And yet one can often derive a certain amount of benefit from a discussion (however ludicrous) with a man whose ideas are perhaps a bit dubious. I remember a works' electrician (he had actually had no technical right to the position, I found) who complained that his boss wanted to know what he was doing with power-factor in the works. The electrician was not aware that he had any such thing in the place, but had promised to look into the matter. One day, when I was in their sub-station, the electrician approached and made indirect inquiries anent "this here power factor that's knocking about." His own discoveries had led up to this illuminating stage: the power factor had appeared soon after the supply company had installed a sine meter, and he had also noticed that, although his load fell, the registration on the new meter *didn't*. And it was when the next account was presented to his employer that the alarming fact had emerged—although the units had decreased, the bill was nearly as heavy as of yore. Thus did a p.f. penalising clause assert its disturbing self—and the "electrician" find a new and weird effect.

On another occasion it was my duty to calculate the existing power factor in a rope works, and I was obtaining my data from a polyphase watt-hour meter. The electrician stood by, obviously interested but quite in the dark. At last his curiosity overcame his diffidence, and he asked me what I was doing. Still considering my figures, I murmured that I was "getting the power-factor from the meter." He looked inside the meter several times, and then he stared hard at my thoughtful self. While I was making my way out his intent gaze followed me, and as I closed the door he turned again to the meter and bent a puzzled look at the rotating disk. I have often wondered whether his search was ever rewarded.

During a visit to a factory, partly shut down, I was surprised to find a low load and a p.f. of about 0.2 on a particular circuit. I sent for the electrician, and checked my connections and figures. By the time I had verified my facts the electrician arrived, and I inquired about his power factor. In this case there was this reply, accompanied by an emphatic shake of the head: "No, we don't keep any of that here." However, I was sure that they *did*! Eventually I found that the load in question was an old 75-h.p. squirrel-cage motor driving idle shafting which was running in ball-bearings! When I told the electrician that they *did* have a power factor (and an unusual one, too) a broad grin appeared on his face, and he showed every sign of being quite proud of the fact. As he had never heard of the condition before, his original emphatic disclaimer was quite natural—but never again did I go by face values!

When, later, I visited another place I was a little more wary. The man who claimed to be in charge of the electrical gear regarded me with open suspicion, and I, for my part, had my doubts about *him*. "Have you any idea of your power-factor here?" I asked. "I'll turn it on for you," he replied, and began to edge away. "Just a moment," I said. "Do you know what I mean?" "I'll turn it on for you," he insisted. So I gave it up and let him "turn it on." He approached a Reyrolle switch and, with a great deal of *empressement*, closed it. "There you are," he said, "I've turned it on." I came to the conclusion that "it" must be the power. However, I suppose that in a way he *was* right.

Then there are those terrible people who have just a vague idea about power-factor. What desperate things they do and say! A little knowledge is indeed a dangerous thing. I was once much amused by a man who persisted in arguing about his "wattless opponent"; afterwards I thought that in a sense his malaprop term was rather fitting—we *are* "up against" the reactive element. And there was another acquaintance who reminded me of the man with the 75-h.p. squirrel-cage motor, for, in terms of the greatest satisfaction, he announced that his place had plenty of *reaction component*. (But maybe he was a radio fan in his "off" hours.)

At a colliery I made inquiries as to whether the load conditions could be controlled. Yes, they could. *What sort would I like?* At first I was puzzled; and then a great light dawned on me when the electrician said that he could make the load *strong or weak* at will. The input was to a synchronous motor, and he was referring to the excitation. As I wanted a leading p.f., I asked for it to be made a little strong.

Another enterprising fellow informed me that he had already worked out his power factor. This was his method: Multiply the volts by the amps. and divide the product into the reading on the maximum-demand indicator. He was on the right track, but he did not take into consideration the facts that the supply was 3-phase and that the demand indicator had a constant; in addition his switchboard instruments had big zero errors. The staggering point which emerged was that in spite of all these "snags" his result was not far out!

At a works which had a bad character in respect of power factor the electrician decided to install an indicating power-factor meter. I can say without hesitation and with perfect truth that this step resulted in immediate benefit—but not quite in the way you might think. The power-factor meter was, without authority, connected-in on the polyphase meter circuit, and in such a manner as to shunt its current coils. I said that the installation of the instrument was beneficial to the consumer. It was. The consumption at once dropped by several thousands of units per week!

One last incident in conclusion. A certain colliery electrician worked at a pit not far from a small waste-heat station. Now the latter was at the end of a long transmission line, and invariably it took the wattless load. Our friend had in some way found out the latter fact and had brooded over it. And when, one day, a supply-company engineer visited the colliery sub-station, the electrician had completed his deductions, and he flung this fierce denunciation at the inoffensive visitor: "I've got your —— company weighed up. You're sending me nothing else but wattless—that's what you're doing!"

Investigations on the Structure of Quenched Carbon Steels.

By B. D. ENLUND (Degerfors, Sweden).

(Abstract of a Paper read before the IRON AND STEEL INSTITUTE.*)*

THE paper deals with investigations made by the author into the structural alterations which take place in carbon steels when quenched, mainly by observations as to the change in electrical resistivity and specific volume with annealing temperature.

Plain "high-carbon" steels have a partially austenitic structure when sufficiently intensely quenched. A typical structure is one in which martensite needles are embedded in a ground mass of austenite. If this structure be annealed, the martensite needles are transformed into troostite at about 100 deg. C., but the austenite does not change until the temperature is raised to about 260 deg. C. If the steel is of low or medium carbon content it does not present this "two-phase" structure, even if it is quenched from a very high temperature. In the case of a low or medium steel quenched from 960 deg. and 1,100 C., the structure is very indefinite, and it is impossible to discern if it is formed of more than one phase.

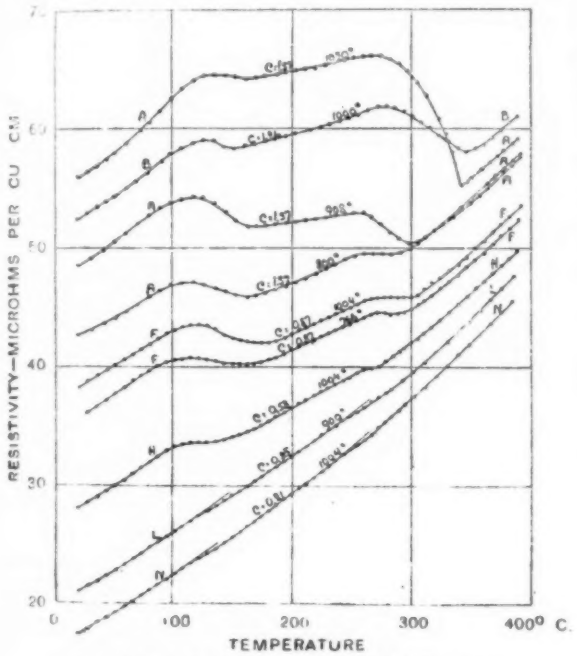


Fig. 1.—Curves showing the Change of Resistivity during Annealing at Annealing Temperatures.

The results also indicate that it is not even necessary to quench mild or medium steels at an unusually high temperature to retain some untransformed austenite. That all carbon steels quenched in water in the ordinary way contain some austenite has recently been confirmed by X-ray analysis. A steel containing 0.80 per cent. of carbon, quenched from 750 deg. C., gave an X-ray photogram in which distinct interference could be seen.

In the experiments carried out by the author the electrical resistance was measured in the ordinary way by determining the decrease in pressure between two points of a cylindrical rod through which a current was passed. The quenched specimen was heated in an electric furnace, the temperature of which could be easily regulated. The wires in the circuit for measuring the pressure, being of nickel, formed a thermocouple together with the specimen, and any difference in the temperature of the two welding points gave rise to a thermocurrent. By means of a millivoltmeter coupled in this circuit, it could thus be ascertained whether the specimens were uniformly heated. The temperature was measured by means of a platinum platinum-rhodium thermocouple, the junction of which was placed in a hole in the centre of the specimen.

The temperature was raised at the rate of 6 deg. C. per minute, and determinations of the resistance were made at intervals of 10 deg. C. Owing to the complicated shape of the specimens, only relative values of the resistance could be derived in this way. A determination of an absolute resistance value was, however, carried out on a cylindrical rod without any holes and weldings, which had been quenched together with the other specimen made of the same steel. The value thus obtained was used as a basis for the curves representing the change of resistivity with annealing temperature. These absolute determinations were performed by means of an Enlund apparatus (Siemens & Halske, Berlin), an instrument constructed by the author for steel analysing purposes.

The change of resistivity with annealing temperature is shown by the curves of fig. 1. All the curves show two bends, one at 110 deg. to 120 deg. C., and another at about 250 deg C. or 260 deg. C., according as the carbon content of the steel is high or low. These bends are visible in all the curves, thus indicating that the same reactions occur in all the steels.

The bends of the curves consist in all cases of deviations towards the temperature axis, which indicates that a precipitation of cementite takes place at the temperatures mentioned. As is well known a reaction of this kind is always accompanied by an increase in electrical conductivity. In analogy with what is known to take place in high-carbon steels quenched from a high temperature, it may thus be concluded that the first break in the curves is caused by the transformation of martensite into troostite, and the second by the splitting up of austentite into α-iron and cementite. Though very slight, the second bend in the curves of the mild steels is quite distinct, and it is thus evident that even such steels are not free from γ-iron.

The curves discussed so far give the impression that the reactions which take place in annealed steels are restricted to certain relatively narrow ranges of temperature. It must, however, be borne in mind that if some slowly proceeding reactions arise during annealing, they cannot be detected in the curves so long as the change of resistivity caused by the rise in temperature alone is not exactly known. The breaks in the curves correspond only with certain maxima of reaction velocity. To get a more exact idea of the real progress of the annealing reactions it is necessary to proceed in another way.

For this purpose the author has determined the electrical resistivity, at ordinary temperature, of quenched steel specimens, annealed for half an hour at a series of temperatures, differing from 10 to 20 deg. C. in the range 0 to 390 deg. C. The annealing was in this case effected in an electric Heraeus furnace, allowing exact regulation of the temperature within ± 1 deg. C. for any length of time. The steels investigated were the same as those in the case of fig. 1. The values obtained are given by the curves of fig. 2.

All the resistivity curves of fig. 2 have the same shape. At

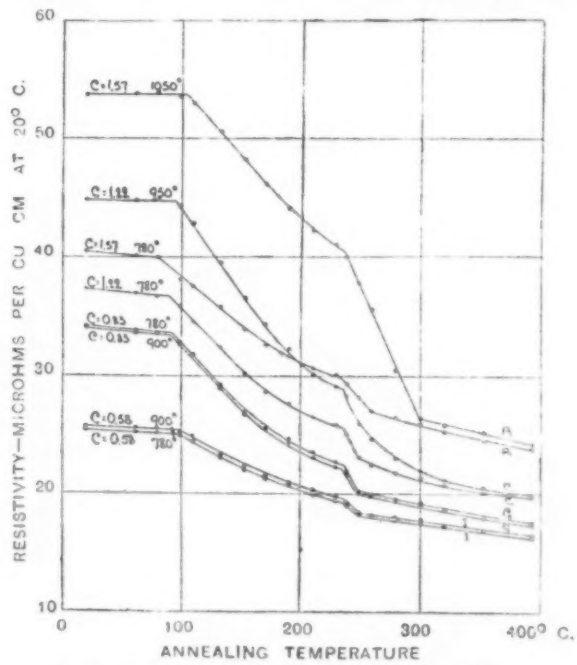


Fig. 2.—Curves showing the Change of Resistivity during Annealing at Normal Temperatures.

100 deg. C., or somewhat below this point, a rapid fall sets in, which continues, though somewhat more slowly, at higher temperatures until, at about 240 deg. C., a new very strong fall again appears. This fall ceases at a temperature between 250 deg. and 300 deg. C., according as the carbon content is low or high. At still higher temperatures the curves decline very slowly.

The breaks in these curves obviously prove the existence of the same reactions as those evidenced by the curves discussed above. The changes in the steels appearing at a somewhat lower temperature in the latter experiments must be due to the longer time of annealing. It may thus be concluded from the curves of fig. 2 that the reaction setting in at about 100 deg. C. is not suddenly completed, but progresses at a somewhat moderated rate at higher temperatures likewise.

Reviews.

Pulverised and Colloidal Fuel. By LEONARD C. HARVEY, M.I.&S.Inst., M.Inst.Met. Pp. xxvi+466; figs. 244; plates 5. London: Macdonald & Evans. Price 42s. net.

This comprehensive treatise is a veritable mine of information on an important subject, but it is well arranged, and provided with a good index, so that, unlike most mines, one does not have to dig for the material. It is well printed, well illustrated, and gives plans and tables which should prove of great service to many engineers who now have powdered or colloidal fuel under consideration. The full title of the book includes fuel economy and smokeless combustion, and a great deal of the information given is applicable to furnace problems in general. In addition to giving strictly technical information, the author has given the names of all the principal firms engaged in building the plant described, a feature of value which we commend to other technical authors who are prepared to describe the products of many manufacturers without showing undue bias towards any one of them.

In these busy times it is a great help to be told at once who makes any particular type of apparatus instead of having to search and inquire. The author appears to us to have presented the specialities of the many competing firms with fairness, and, while pointing out the advantages or disadvantages of any particular method, he avoids most successfully any invidious comparisons.

A mere statement of the contents of this volume would exhaust our available space—although bulky and detailed, the information is brought well up to date, and time is not wasted with elaborate histories of early efforts. The present condition of the art of preparing and burning to the best advantage pulverised and colloidal fuels is the main theme; it is discussed in connection with steam boilers of every type, stationary, locomotive, and marine; and the use of these fuels in metallurgical work and furnaces for many other purposes than the production of power is also treated. Efficiencies and costs are largely set out, and the information given in the form of tables and otherwise is sufficient to enable an engineer to form preliminary decisions as to the relative advantages of different systems for any set of circumstances.

Pulverised fuel offers most of the advantages of oil fuel with an increased economy. The author is, however, very careful to say that these advantages are only to be obtained under suitable conditions, and that to promote wholesale scrapping of solid fuel installations and the substitution of pulverised fuel indiscriminately would be a vital error. On the other hand, under favourable conditions, a reduction in the cost of fuel might be secured amounting to between 30 per cent. and 50 per cent. A very useful table is given on page 55, showing in a classified form the fuels available in many of the principal countries of the world. Many furnace and boiler tests are set out in full.

Methods of coal washing and preparation of coal for mixing with oil or oil and tar to form a colloidal fuel are fully treated, and the advantages of the mixed or colloidal fuel are discussed.

Complete coal handling and mill house plants are fully described and illustrated. Fig. 55, opposite page 151, shows a heavy crane type of lifting magnet which appears to have crept in by error as it is not to be supposed that it could be used in connection with fuel. Below are given illustrations of magnetic belt pulley separators for the removal of pieces of iron frequently found in the raw coal, which must, of course, be removed before pulverisation takes place. The preliminary crushing is also well illustrated and described, and pulverising mills are fully treated, as well as the drying plants which are an essential feature of the central supply system.

On page 190 a tabulated statement of the costs of buildings and standard mill house equipments is given, based on 1922 prices for labour and material, and further figures and calculations are given to show that in this, as in most other engineering problems, the capacity of the plant to a great extent governs economical production.

On page 281 interesting figures are given as to the loss of combustible material in clinker from various mechanical stokers, varying from 4.6 per cent. to 6.5 per cent. of unburnt carbon, though higher percentages are recorded in gas producer ash. Losses owing to banking fires are also set out and must be taken into the comparison with ordinary coal-fired systems, as, of course, the colloidal fuels or pulverised coal can either of them be put into action instantaneously and steam raised very quickly, thus largely dispensing with banked fires.

Interesting suggestions with regard to the removal of the ash are made on page 286, where it is pointed out that by providing air inlet ports it can be arranged that the ash falling into the combustion chamber is kept at a temperature below its point of fusion, which enables it to be removed in a convenient loose powdery form. An opposite plan is adopted at the Erie City Iron Works, U.S.A., where the small combustion chamber is provided with a complete jacket of water tubes built into the walls of the chamber to prevent the fusion of the firebricks. The feed water is heated by means of these tubes, and the temperature of the furnace is kept high enough to fuse the ash, which is run off as a slag and all difficulties with dust on tubes and in the flues are thus obviated.

The opinions of Mr. L. C. Harvey, the author, are given in a general way in the introduction, which should on no account be skipped over. On page 9 he commits himself to a favourable opinion about self-contained units, in which the coal is pulverised and supplied direct to each furnace, and he says there are numerous instances where such units mostly prove decidedly more economical in first cost and in results achieved than the expensive plant necessary for the preparation of pulverised fuel in bulk and its storage and distribution. It is interesting to note that in the United States, however (where everything seems possible), there are actually in existence central pulverising plants, from which the pulverised fuel is distributed to different customers by main pipe lines. In other instances it is delivered in casks by motor lorry, the empties being brought back for re-filling. Such an arrangement, of course, saves capital outlay to the small user. An illustration of the Kinyon small consumer's equipment is given opposite page 367.

It is within the writer's knowledge that a very important development in self-contained units is at present taking place in this country, and it seems to him probable that an equipment which consists of a pulveriser with an ignition chamber installed in the space below the boiler, usually allotted to a mechanical stoker, would have enormous advantages over any central pulverising, storing, and distributing system, not the least being the absence of the danger of explosion involved in the storage and delivery of finely pulverised fuel.

On the whole, we are inclined to rank this book of Mr. Harvey's as one of the most comprehensive, well arranged, and accessible works of reference that has been put into our hands for some time.

The Home Constructor's Easy-to-Build Wireless Sets. By F. H. HAYNES. Pp. 61. Figs. 47. London: The *Wireless World*. Iliffe & Sons, Limited. Price 1s. 6d. net.

Mr. Haynes is assistant editor of *The Wireless World and Radio Review*, and has an extensive experience of the needs of the amateur experimenter.

In this book he gives full constructional details of receiving apparatus arranged progressively so that the constructor can commence as a novice with a simple crystal set and finish as an experienced constructor with a loud speaker.

There can be no doubt that this is the proper line to work on, and it is a pity that so many recruits to the ranks of the amateur constructors are started off on wrong lines by being enticed to plunge at once into the construction of difficult sets; thus, more often than not, they become disheartened and lose the enthusiasm without which all progress must eventually shrivel up.

Another point which the author keeps before him throughout is that, in the early stages at any rate, the average amateur has few facilities for construction, a point of great importance and one frequently overlooked in books of this sort.

The sets dealt with consist of a crystal set, single valve set, note magnifier, three-valve set, h.f. amplifier and detector valve set, and a power amplifier.

All these are described simply with full constructional details and easily understood working drawings.

Wireless Valve Receivers and Circuits in Principle and Practice. By R. D. BANGAY and N. ASHBRIDGE, B.Sc., A.M.Inst.C.E. Pp. viii+116. Figs. 77. London: *The Wireless World*. Iliffe & Sons, Limited. Price 2s. 6d. net.

The fact that this book covers so extensive a field is made possible by its conciseness and by the restriction of explanatory matter to straightforward circuits representative of sound practice.

The authors have been careful to avoid mathematical explanations and, in fact, to eliminate everything which is not essential to a reasonably clear understanding of the phenomena described. This is no easy task, and though it has been well carried out, a reader unacquainted with the subject will find that he must give close attention if he is to understand fully the information set before him.

About a third of the book is devoted to the general principles of valve reception, and two-thirds to descriptions and explanations of single valve, two valve, combined valve and crystal receivers, supersonic and super-regenerative amplification, and frame aerial reception.

This book will be found very useful to the serious amateur experimenter who is not satisfied with blindly following out working drawings, but wishes rather to understand the principles on which his circuits operate.

Sir Robert Blair Fellowships.—Two Fellowships will be awarded by the London County Council this year in commemoration of the services of Sir Robert Blair, Education Officer of the Council, from 1904 to 1924, to enable young engineers to study engineering progress abroad, particularly in the United States and the Dominions. These Fellowships, which carry a grant of £450, are available for British subjects at least 21 years of age, preference being given to students of engineering science and to those who have completed a course of study in London institutions or have been identified with the London teaching service.

Business Notes.

Electrical and Allied Advertising: Our Competition.—With a view to assisting advertisers in their efforts to secure the best results from their advertisements appearing in the ELECTRICAL REVIEW, we have decided to offer three prizes of substantial value (£100, £50, and £25) to companies, firms, or representatives thereof, responsible for the best series of six full page, half-page and quarter-page advertisements published in the REVIEW during the next six months.

Full particulars of the Competition are announced in our advertisement pages to-day (Supplement, p. 18). The competing advertisements will be judged by gentlemen whose independence is beyond question. Their names will be announced later. The judges will give special thought to the following points:—Power of immediate attraction; qualities compelling continued attention; boldness of design; and artistic arrangement.

Buy British Goods!—The Federation of British Industries has addressed to the President of the Board of Trade a memorandum in which it suggests that the Government should organise or assist in organising an intensive campaign to impress upon the public the importance of purchasing British goods. It points out that during last year the manufactured imports into this country reached a value of nearly 300 million pounds and that if only a small part of this amount were diverted from foreign to British producers the relief in unemployment and the gain in revenue would far more than compensate the Government for any expenditure involved. The suggestion is that the campaign should be carried on in the newspapers and by other means for a period of not less than two years.

Liverpool Hospital Saturday Fund.—For the 12 months ended June 6th, the staff and workpeople of the Automatic Telephone Manufacturing Co., Ltd., Liverpool, have contributed the sum of £395 11s. 9d. to this fund, for distribution amongst the various Institutions of the city. This constitutes a record, and a marked advance on last year's figures. Altogether since the company was constituted in January, 1912, a total of £1,631 has been thus contributed to the finances of the various city hospitals, as a result of voluntary contributions by A.T.M. employ's.

Trade Announcements.—MESSRS. PHILIPS LAMPS, LTD., have opened branch offices at Birmingham and Bristol as follows:—65, Parwick Street, Birmingham; and 29, Upper Arcade, Bristol.

MESSRS. F. J. JONES & SONS, LTD., electrical engineers and contractors, of The Eastgate, Chester, have opened additional premises at Tarvin.

The J. G. BRILL CO. has removed to Aldwych House, Aldwych, London, W.C.2.

MESSRS. INNISS & RIDDLE, 86 New Street, Birmingham, have been appointed as sole agents for Warwickshire, Worcestershire, and South Staffordshire for Northumbria Motors, Ltd.

The NEWMAN ELECTRICAL CO. has removed from Rathbone Place to 5, Newman Street, London, W.1. The warehouse at 29, Percy Street, W.1 is retained.

Bankruptcy Proceedings.—A. T. K. MOIR, trading as Moir and Watts Weardale Road, Lee, Kent, electrical and mechanical engineer.—The first meeting of creditors was held on June 12th. The statement of affairs showed liabilities of £3,258, of which £2,593 was expected to rank, against net assets of £1,687, leaving a deficiency of £906. Debtor attributed his failure to inability to exercise proper supervision and obtain orders during 1923 owing to illness, lack of capital, depreciation in value of stock, depression in trade, keen competition, and loss of £200 on a contract completed in 1924. The creditors resolved to appoint Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., as trustee, with a committee of three of the creditors.

J. A. FRASER, electrical engineer, Sanctuary House, 33, Tothill Street, Westminster, S.W.—Receiving order made June 9th on creditor's petition.

V. R. GARUSHY (Wenham Lighting Corporation), electrical factor, 184, Gray's Inn Road, W.C.—Receiving order made June 10th on creditor's petition.

R. PATTISON, electrical supplies factor, 15, Goldsmith Street, Nottingham.—Receiving order made June 8th on debtor's own petition.

J. HILL, G. NOBLE, AND E. COWLEY (G. Hill & Co.), electrical engineers, 22, Chantry Lane, Great Grimsby.—Last day for proofs for dividend, June 24th. Trustee, Mr. J. F. Wintringham, St. Mary's Chambers, Great Grimsby.

BURKETT, electrical engineer, 185, John Day Street, and 78, Anderson Street, South Shields.—First and final dividend of 2s. 2d. in the £ payable June 22nd at the Official Receiver's office, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

N. DAVENPORT AND L. A. HACKETT (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens, Manchester. Trustee, Mr. A. Grierson, 21, Spring Gardens, Manchester, appointed June 9th.

T. S. KENNEDY (Martin & Co.), electrical engineer, 102, High Street, Stoke Newington, N.—First and final dividend of 2s. 2d. in the £ payable June 29th at the offices of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C.

Company Liquidations.—F. R. S. LAMPS, LTD., Station Street, Birmingham.—A meeting of the creditors of this company was held recently. Mr. W. E. Withnall, C.A., Birmingham, submitted a statement of affairs which disclosed liabilities of £4,539, made up as follows:—Trade creditors, £1,436; bank overdraft, £1,533; directors' claims, £1,195; and contingent liability, £235. The assets were estimated at £1,012, from which had to be deducted £120 for preferential claims, leaving net assets of £892, or a deficiency as regarded the creditors of £3,507. The deficiency, as regarded the shareholders, was £7,613. It was reported that the company was registered in April, 1922, when it took over the business which had previously been carried on by Mr. F. R. Swinburne. At that time there was a considerable turnover. A number of shares had been issued for cash. The first year's trading showed a loss of approximately £3,800. At the end of 1923 there was a loss of £1,596, whilst last year there was a trading loss of £1,588. During the present year there had been a loss on the trading of £471. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Withnall as liquidator, together with an advisory committee of the representatives of three of the principal creditors.

SPARKES ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. E. W. Viney, Mansion House Chambers, 11, Queen Victoria Street, E.C. A meeting of creditors was called for June 17th at the offices of the liquidator.

CAR LIGHTING SET CO., LTD.—A meeting of members is called for July 10th at 3, Warwick Court, Gray's Inn, W.C., to hear an account of the winding up from the liquidator, Mr. R. F. W. Fincham.

DUX ELECTRIC QUILT AND FIBRIL, LTD.—A meeting of members is called for July 14th at Arcade Chambers, Wigan, to hear an account of the winding up from the liquidator, Mr. E. W. Johnson.

Catalogues and Lists.—MR. J. S. PLUMTREE, 90-91, High Holborn, W.C.1.—An illustrated pamphlet describing epicyclic geared motors for low-speed drives. Priced.

MESSRS. HIGGS BROS., Witton, Birmingham.—A stock list of a.c. and d.c. motors.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A priced and illustrated catalogue of radio receiving sets and parts; a booklet dealing with Brandes telephones and loud speakers; and a priced leaflet advertising "Lotus" geared vernier coil holders. Also illustrated and priced pamphlets dealing with electric fans and portable battery-charging sets.

MESSRS. J. H. TAYLOR & CO., Macaulay Street, Huddersfield.—A comprehensive catalogue of radio apparatus of all makes. Priced.

THE HILLBAR PRESS, 473, High Road, Leyton, E.10.—A pamphlet advertising equipment for the manufacture of dry cells.

MESSRS. NEGRETTI & ZAMBRA, 38, Holborn Viaduct, E.C.1.—List No. C6, containing full details, illustrations and prices of indicating and recording distance thermometers.

THE HOYT METAL COMPANY OF GREAT BRITAIN, LTD., Deodar Road, Putney, S.W.15.—A pamphlet entitled "Hints on Lining Bearings" giving directions for the use of Hoyt anti-friction metals.

MESSRS. COLE, MARCHENT & MORLEY, LTD., Bradford.—A pamphlet containing particulars of the company's closed circuit air cooler.

A New Method of Packing V.I.R. Wires.—About three years ago W. T. Henley's Telegraph Works Co., Ltd., introduced a new method of packing v.i.r. wires. These had previously been simply wound in coils which were wrapped round with Hessian tape and the wire was inaccessible without a great deal of trouble. Messrs. Henley's accordingly instituted packing in a cardboard carton which had many advantages over the previous method. Even this had its drawbacks, however; the principal one was the lack of an easy method of carrying the coils. Therefore the company has now adopted cardboard reels for this purpose, which provide a neat packing and, having a hole through their centres, can be fixed on to the handle of a bicycle or carried on the arm.

Lead. — Messrs. James Forster & Co. reported on June 13th that consumption continued on a large scale, the cablemakers taking a hand. "Supplies on the other hand are falling off, only 5,000 tons having arrived in London and Liverpool up to the 11th inst. Good brands of lead are getting scarce, and with imports from America expected to be only on a small scale, there is a prospect of the position tightening up before long, with a probable widening of the backwardation."

The First-fruits of the E.D.A. Appeal.—The Manchester Electricity Committee has agreed to increase its annual subscription to the funds of the Electrical Development Association from one-fortieth of one per cent. to one-tenth of one per cent. of the revenue of the undertaking.

The manager of the Glasgow Electricity Department recently submitted a statement and report as to the publicity and other work carried on by the Electrical Development Association, and the Electricity Committee recommends that a contribution of £1,139 be made by the department to the funds of the Association, this amount being one-tenth of one per cent. of the revenue.

Book Notices.—"Report of the Comptroller-General of Patents for 1924."—The forty-second report of the Comptroller-General of Patents, Designs, and Trade Marks, for the year 1924, has been recently issued. The report shows that the total number of applications received for patents was 31,370. The numbers of provisional and complete specifications dealt with were 20,840 and 18,500 respectively. The number of patents sealed was 16,839, against 17,697 in 1921, and 15,036 in 1914. The number of applications received for designs was 22,155, of which 20,155 were registered. 12 479 trade mark applications were received, of which 4,837 were registered.

The receipts from patent fees were £285,592, from design fees £11,954, and from trade-mark fees £49 704, as compared with £333,615, £10,709, and £47,991 respectively for 1923.

"*Journal* and Record of Transactions of the Junior Institution of Engineers." Vol. XXXV, Part ix, June, 1925. London: Percival Marshall & Co. Price 2s.

"Catalogue of British Scientific and Technical Books," compiled by the British Science Guild. Pp. xxii + 489. London: A. & F. Denny, Ltd. Price 12s. 6d. net.

"Government Department Electrical Specification." No. 9, Electric Cables N, Class (rubber covered for electric power and light). Pp. 15, figs. 2. London: H.M. Stationery Office. Price 6d. net.—This is a complete Government specification for the manufacture and testing of V.I.R. tough rubber sheathed cables, or as they are more generally known, cab-tire-sheathed cables. The requirements are set out in tabulated form.

"Power Station Operation." Vol. I. Pp. 30. Illustrated. London: Electrical Times, Ltd. Price 3s. 6d. net.

"Electric Vehicles," by C. W. Marshall. Pp. xii + 96; figs. 43. London: Chapman & Hall, Ltd. Price 9s. 6d. net.

"Relativity," by Sir Oliver Lodge, F.R.S. Pp. 41. London: Methuen & Co., Ltd. Price 1s. net.

"Mechanical Appliances, Mechanical Movements, and Novelties of Construction," by G. D. Hiscox. Pp. xiv + 412; illustrated. London: Constable & Co., Ltd. Price 21s. net.

"The Story of Electricity," by W. F. F. Shearcroft. Pp. 73. London: Ernest Benn, Ltd. Price 2s. 6d. net.

The Summer Number of *Punch* (one shilling), just issued, is good as usual.

A Rumanian Loan Contract. — It is reported from Bukarest that Brown, Boveri & Company have granted a seven years' loan to the city of Czernowitz in the form of the delivery of extension plant for the electricity works and the tramways. The loan will bear interest at the rate of 4 per cent. above the English Bank rate. The Czernowitz works was formerly closely associated with the German Schuckert interests.

For Sale.—Manchester Corporation Electricity Committee has for disposal six 150-kW synchronous motor generators, two 80-kW traction boosters, two 100-kW and one 200-kW transformers. By order of the receiver for the debenture holders of Messrs. Cutting Bros., Park Works, Stamford, Messrs. H. Butcher & Co. invite offers for the purchase, as a going concern, of the above old-established electrical engineering works. By order of the receiver for the debenture holder, *re* the Bell Battery & Accessories Co., Ltd., Messrs. H. Butcher & Co. will sell by auction on June 23rd, at 83, Lawrence Road, Tottenham, the plant and stock of an electric battery manufacturing business. (For further particulars see our advertisement pages to-day.)

Our Foreign Trade.—MAY FIGURES.—The following were the values of imports and exports of electrical goods and machinery during May, 1925:—

Imports.—	May, 1925.	Inc. or dec.	5 months, 1925.
	£	£	£
Electrical goods and apparatus	275,199	+ 11,995	+ 574,569
Machinery	1,065,433	− 61 585	+ 756,927
(Electrical machinery)	99,295	− 18,473	+ 24,095
Exports.—			
Electrical goods and apparatus	1,161,633	+288,386	+1,196,393
Machinery	4,390,166	+414,572	+2,723,416
(Electrical machinery)	546,738	+ 89 412	+ 461,749
Re-exports.—			
Electrical goods and apparatus	28,648	+ 13,474	+ 50,557
Machinery	147,306	− 19,915	+ 81,025
(Electrical machinery)	5,609	− 4,497	− 12,971

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from June 3rd:—

Superial. No. 458,041. Class 5. Electric wire.—The New London Electron Works, Ltd., Boleyn Road, East Ham.

Marzite "Brings It Near" (lettering and design).—No. 447,626. Class 8. Detector crystals for use in radio-telephony and telegraphy.—H. A. Cureton, 23, Horsfield Road, S.E.9.

Emanometer. No. 455,831. Class 8. Apparatus for the investigation and detection of emanations proceeding from substances, mineral, vegetable, or animal, for the purpose of analysing their particular type of electrical activity.—W. E. Boyd, 17, Sandyford Road, Charing Cross, Glasgow.

Ultron radio crystal (lettering and design). No. 458,352. Class 8. Detector crystals for use in radio-telephony.—Neutron, Ltd., Sicilian House, Southampton Row, W.C.1.

Co/l. No. 457,717. Class 11. Electro-medical apparatus and appliances.—Elektricitäts Gesellschaft "Sanitas," 131d, Friedrichstrasse, Berlin, N.24. (British representatives: Herbert Haddan & Co., 31-32, Bedford Street, Strand, W.C.2.)

Stabee (lettering and design). No. 456,896. Class 50. Electrical insulating substances of asbestos, resin, mica, oil or bitumen.—The New Eccles Rubber Works, Ltd., Monton Road, Eccles, Manchester.

An Attractive Window Display.—Messrs. Selfridge, who always keep their display windows up to date, have in one of them arranged a boating scene. In the foreground are a punt and three figures, one of which wears a pair of headphones connected to a B.T.-H. "Radiola" receiving set.

Chinese Notes.—The Chinese Electric Light Co. has commenced operations in Lungchingtsun, Kirin province.

A party of foreign experts is engaged upon a study of the hydro-electric possibilities of the Lungmen rapids on the Yellow River.

A public telephone service has been established between Munchun and Hsianosanch ak (Ki in province).

A private radio company is being formed in Canton, where at present all radio services are controlled by the Government.

Unemployment.—The Employment Exchange registers on June 2nd showed a total of 1,247,300 wholly-unemployed persons (971,200 of them being men). This was 60,500 more than the previously published figure and an increase of 214,385 in the twelve months.

Social Events.—The sixth annual sports and children's outing organised by the staff of the Yorkshire Electric Power Co., took place on June 7th at Thornhill Rectory Grounds, kindly placed at the disposal of the company by the Rector, the Rev. H. T. Hayman, M.A. A perfect summer day favoured the event and the beautiful grounds were at their best. The band of the 4th Batt. K.O. Yorks. L.I. played selections during the afternoon and evening. The catering arrangements were in the hands of Mr. George Sykes, of Birstall, who was assisted by a number of lady members of the company's staff. Mr. Lionel Balmer, a member of the staff, gave a most enjoyable and clever exhibition of "magic."

On June 6th, the staff and employés of the Paisley Corporation Electricity Department went for their annual excursion, proceeding to Campbeltown, *via* Gourock by steamer. Mr. W. Blair Smith (the chief engineer) and Bailie Balderston (convener of the Electricity Committee) were among the party, which numbered about 120.

The Absorption of a French Cable Company.—The shareholders of the Compagnie Générale des Câbles de Lyon have approved a scheme submitted by the directors under which the undertaking will be transferred to the Compagnie Générale d'Electricité, which will issue one new share in exchange for two shares in the cable company.

"Kathanode" Batteries at Wembley. — The "D.P." Battery Co., Ltd., states that over 120 "Railodok" cars are in use again this year at the British Empire Exhibition and all are fitted with the same "Kathanode" batteries which operated during last year, in spite of the conditions which were encountered.

Alleged Trading Frauds.—*The Times* reports that on June 12th at Old Street Police Court, Anatole Ivan Zaitzeff, Naum Abram Ludwin, James Smith-Hickie, and Walter Wynne Williams were charged with conspiracy to defraud and false pretences. The offences were alleged to have been committed at Bunhill Row, E.C., between July 30th, 1923, and June 1st, 1925.

Mr. Gwatkin, for the Director of Public Prosecutions, said that the businesses involved in the conspiracy were eight in number, *viz.*, the General Distributing and Trading Co., Ltd.; the British and Overseas Dental Supplies, Ltd.; N. A. Ludwin & Co.; Importex, Ltd.; the Lancashire Trading Co., Ltd.; A. I. Zaitzeff & Co.; Darag, Ltd.; and B. A. Ludwin. He said that he would show, in the course of evidence, that as one business failed to meet its responsibilities, another came into being and carried on the same class of business at the same address and with the same people concerned in the management. After hearing formal evidence regarding the premises, &c., Mr. Watson (the magistrate) ordered a week's remand, making the bail continuous.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report, June 16th:—Copper (electrolytic) bars, £64, 10s. inc.; ditto, ditto sheets, no change; ditto, ditto wire rods, £74, 10s. inc.; ditto, ditto h.c. wire, no change.

Messrs. James & Shakespeare report, June 16th:—Copper bars (best selected) sheet and rod, £88, £2 decrease; English pig lead, £34 15s., 10s. dec.

Messrs. Edward Till & Co. report, June 16th:—No change in the price of india rubber (Para fine).

Lighting and Power Notes.

Australia.—TASMANIA.—According to *Tenders*, the Tasmanian Government has decided to proceed with extensions to the hydro-electric scheme at an estimated cost of £300,000. The first section will include construction of diversion works, channel and penstock chamber. Later, tenders will be invited for the construction of a power station with a capacity of 12,000 h.p.

Aylesbury.—ELECTRICITY EXTENSIONS.—The Corporation is applying for sanction to loans of £53,079 for extending its electricity supply to rural areas, and £3,000 for the provision of a 400-kW converter.

Burton.—YEAR'S WORKING.—We have received from Mr. W. J. H. Wood, electrical engineer and manager of the Corporation electricity works, an abstract of the accounts of the electricity department for the year ended March 31st last. The total revenue was £203,125, and working expenses were £149,675, leaving a gross profit of £143,450. The figures for the previous year were:—Income, £273 598; working expenses, £131,013; gross profit, £142,585. After payment of capital charges, a balance of £25,915 was carried to appropriation account, together with a balance of £25,073 brought forward from the previous year, making a total of £48,988. This was distributed as follows:—Revenue contributions to capital, £17,000; transferred to district fund, £4,400; carried forward, £27,588. During the year £85,563 was spent on capital account, the main items being £41,403 for extensions to Back-o'-th'-Bank works, and £24,065 for mains. The sales of electrical energy amounted to 47,920 033 kWh, as compared with 42,561,016 kWh in 1923-24, and the average price per kWh obtained was 1.25d. as against 1.31d. The maximum supply demanded rose from 19,310 to 21,400 kW.

Bradford.—MAINS EXTENSIONS.—The Electricity Committee is applying for sanction to the borrowing of £20,000 for mains. The City Council has approved mains extensions in the Eccleshill district at an approximate cost of £6,619.

Burton-on-Trent.—YEAR'S WORKING.—The report of the borough electrical engineer, Mr. T. Hall, on the working of the Corporation electricity undertaking for the year ended March 31st last, shows a total income of £80,259, as compared with £88,478 in the previous year, the fall in the receipts being due to a reduction in tariffs. Working expenses totalled £46,501, as against £44,895, leaving a gross profit of £41,058 (£44,583). After payment of capital charges and deducting £1,862, capital expenditure provided out of revenue, there was a net profit of £11,341 as compared with £18,925, of which £2,000 was contributed to the borough fund, the remainder being carried to renewals account. The sales of electrical energy amounted to 13,491,797 kWh, an increase of 914,161 kWh, and the average price per kWh obtained fell from 1.64d. to 1.51d. The maximum supply demanded rose from 4,300 to 4,450 kW. A new 6,000-kW set was put into commission during the year.

Colchester.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking for the year ended March 31st last record a net surplus of £6,169, and in view of the possibility during the current year of having to maintain two stations during transition from the old to the new station, it has been decided to transfer the surplus to reserve. The electrical energy sold amounted to 2,258,253 kWh, an increase of 274,092 kWh, as compared with the previous year. It has been decided to reduce the charges for electricity for lighting by 1d. per kWh, and for power by ½d. per kWh.

Connah's Quay.—ELECTRICITY SUPPLY.—Electricity is now being supplied in the urban district. The sub-station erected by the Council receives energy from the North Wales Power Co. About 50 consumers are connected up, among them being several works and the shipbuilding yard.

Continental.—FRANCE.—The Société L'Union de l'Electricité, of Paris, has recently ordered additional plant for its power station at Gennevilliers, which will increase the capacity to 310,000 kW.

BELGIUM.—The report of the Société de la Centrale Electrique de l'Entre-Sambre-et-Meuse for the last year shows that the output of electricity during the twelve months amounted to 78,838,011 kWh, as compared with 41,160,711 kWh in 1923. A new 12,500-kVA turbo-generator and eight new boilers fired with pulverised coal were brought into operation at the power station in March last. The company has secured a concession from the authorities of the province of Namur for the supply of electricity to about 60 communes in the province. Attention is now being concentrated on the extension of the high-pressure distribution system. A new line has been established as far as Malonne, and it is now proposed to extend this to Dinant, where a 50,000-V transformer station will be established.

Crewe.—EXTENSION OF SUPPLY.—There has been a conference between the Corporation Electricity Committee and representatives of the Nantwich Urban and Rural District Councils on the subject of the development of the electricity supply. The representatives of the local authorities asked the Corporation to furnish them with the price at which it would supply electrical energy at the borough boundary. The Electricity Committee has intimated its willingness to give a supply at the same price as that charged to its own consumers, plus the cost of transmitting the energy. It was also resolved that application be made for a Special Order authorising the Council to supply electricity to an area extending half a mile beyond the limits of the borough.

LOAN SANCTIONED.—The Town Council has received sanction to a loan of £4,100 for the supply of electricity to the West End Garden City.

Finchley.—LOAN.—The Urban District Council is applying for sanction to a loan of £6,000 for mains.

Glasgow.—SYSTEM OF SUPPLY.—The Corporation has received sanction from the Electricity Commissioners to alter its system of electricity supply from d.c. to a.c.

Gravesend.—ELECTRICITY SUPPLY.—The borough electrical engineer has prepared estimates showing that the equipment of the Queen Street sub-station will cost £4,086. The Electricity Committee has asked him to report as to the possibility of adapting the front part of the station as a showroom.

Haslingden.—ELECTRICITY IN SMALL HOUSES.—The Corporation Housing and Town Planning Committee has received the architect's report on the "Kaybee" electric boilers, and has resolved that electric wash boilers be installed in the houses at present in course of erection on the Fields Road site. This is the second housing scheme in which no gas is being used. In addition there are several bungalows which have been similarly fitted.

Hastings.—ELECTRICITY AGREEMENT.—The Corporation has come to the following terms regarding the supply of electricity in bulk to the Bexhill Corporation:—(1) The Bexhill Council to take a supply of current for a period of 25 years, the arrangement to be thereafter determinable on two years' previous notice in writing on either side. (2) The Bexhill Council to cease to generate electricity within its area of supply except at its existing power station at Little Common and not to add to or improve the plant, machinery or equipment at that station. (It is estimated that this power station will be closed within the next seven years.) (3) The agreement to operate in full as from April 1st, 1926, and to contain a clause dealing with the rise and fall in the cost of coal. In connection with the supply the Unemployed Grants Committee has approved the scheme for laying the mains to Bexhill at a cost of £28,000 for the purposes of a grant.

MAINS EXTENSIONS.—The Town Council is to carry out mains extensions at an estimated cost of £6,850.

Hereford.—ELECTRICITY SUPPLY.—The Town Council has decided to apply for sanction to a loan of £5,000 to meet the cost of a duplicate line from Chadnor Court to Leominster. The Council has also decided to offer a bulk supply of electricity to the Ross Electric Light & Power Co., Ltd., on the latter's guaranteeing a minimum annual bill equal to 20 per cent. per annum for three years of the expenditure incurred by the Corporation in giving the supply.

India.—ELECTRICAL DEVELOPMENT.—According to the *Indian Textile Journal*, the foundation stone of the power-house of the Hubli Electricity Co., Ltd., was laid at Hubli, Dharwar District, on March 28th. A beginning has been made with two sets of Mirrlees-Diesel oil engines of 150 b.h.p. directly-coupled with two Siemens 100-kW alternators. In order to provide for the future demand for power supply it is proposed to install another set of 500 b.h.p. immediately after the present sets have commenced working. The system of supply is by means of overhead distribution. The energy will be generated at 3 300 V, and will be distributed at 3-phase, 50 cycles, 400 V.

Messrs. Kelkar Brothers electrical engineers of Bombay, have applied to the Madras Government for a licence permitting them to light the principal streets of Mangalore and to supply power to the mills and factories of the town.

Irish Free State.—BLACKROCK (CO. DUBLIN).—The Urban District Council is to submit to the Free State Ministry of Industry and Commerce a letter from the Kingstown Electricity Committee offering to supply electricity to the township in bulk, on terms similar to those applying in Kingstown.

CLONMEL (CO. TIPPERARY).—At a recent meeting of the Corporation a letter was read from the Local Government Department sanctioning a loan of £8,000 for the proposed electric lighting scheme.

Llantarnam (Mon.).—SPECIAL ORDER.—The Urban District Council has applied for a Special Order authorising it to supply electricity in the urban district.

London.—ST. PANCRAS.—The Borough Council is negotiating with the L. & N.E. Railway Co. with regard to a bulk supply of electricity to King's Cross station. It is proposed to give a supply at a charge of £4 per kW per annum, based on a maximum demand of 450 kW, plus ¾d. per kWh for electricity consumed. The estimated cost of laying the necessary h.p. mains is £6,650.

Marsden.—NEW POWER STATION.—The Electrical Distribution of Yorkshire, Ltd., proposes to erect a power station in Manchester Road.

Oundle.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them for the supply of electricity by the Rushden and District Electric Supply Co., Ltd., in the urban district of Oundle and the rural districts of Oundle and Thrapston.

N.W. Midlands Electricity District.—TIME EXTENSION.—In connection with the extension of the time within which representations may be made and schemes submitted for the reorganisation of the supply of electricity in the North-West Midlands Electricity District, the Electricity Commissioners give notice that they have further extended such time until August 31st, 1925.

Paisley.—LOAN.—The Town Council is applying for sanction to borrow an additional sum of £17,563 for electricity distribution purposes.

Padiham.—ELECTRICITY SUPPLY.—The Town Council has approved a draft agreement with the Lancashire Electric Power Co. for the distribution of electricity within the area. The agreement provides for the company to secure a loan through the Council, to put down distribution plant, and to distribute the supply. The plant will revert to the Council in 21 years. A supply will be available without waiting for the completion of the company's new generating station.

Plymouth.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has resolved to proceed with a scheme for laying h.p. cables through Lipson Vale and Laira at a cost of £21,859, and to make application to the Electricity Commissioners for sanction to a loan. Cable extensions have been authorised in 12 streets at a total cost of £2,396. It was resolved that the charge for the service main on private premises in future should be only in respect of the amount of cable in excess of 40 ft., instead of 20 ft. as hitherto.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

NORTHAMPTON.—*Northampton Electric Light & Power Co., Ltd.*—Lighting: First 200 kWh per quarter, from 7d. to 6½d. per kWh; beyond, from 5½d. to 5d. per kWh. "All-in" assessment rate: From 7d. and 1d. to 6½d. and 1d. per kWh. Power: Sliding scale from 2.5d. to 1.2d. per kWh. Motor rentals reduced by 10 per cent.

LEEK.—Lighting: From 5½d. to 5½d. per kWh, with a discount of ½d. per kWh for prompt payment of accounts.

BROMLEY.—*Bromley (Kent) Electric Light & Power Co., Ltd.*—Power: First 100 kWh per quarter, 6d. per kWh; next 3,000 kWh, 3½d.; beyond, 2½d. For consumers whose consumption is 30,000 kWh per annum or more, an alternative tariff is offered of £7 10s. per kW of maximum demand per annum, plus ¾d. per kWh.

LINCOLN.—Lighting: Below 5,000 kWh per annum 9d. per kWh for the first hour's use and 4½d. per kWh thereafter; 5,000 kWh and over, 9d. and 4½d.; prepayment meters, 7½d. per kWh; kinemas, &c., 6d. per kWh. Power: After the first hour's use from 1½d. to 1½d. per kWh. Where consumption exceeds the equivalent of 1½ hours daily and the consumer agrees to take no supply between 4 p.m. and 6 p.m. during the four winter months: A flat rate of 1½d. per kWh. Radiators: Where the average use is less than 1½ hours daily, 3d. per kWh.

ROTHERHAM.—Heating for domestic purposes: First 100 kWh per quarter, 1½d. per kWh. All energy in excess, 1d. per kWh.

LLANDRINDOD WELLS.—*Llandrindod Wells Electric Light and Power Co., Ltd.*—Lighting: From 10d. to 9d. per kWh.

STRETFORD.—Lighting: From 5d. to 4¾d. per kWh. Power: from 45 to 40 per cent. above the pre-war rate.

DORCHESTER.—Power, heating, and cooking: From 3d. to 1½d. per kWh.

MANCHESTER.—Lighting: A quarterly charge of 10s. for the first 24 kWh consumed and 5d. per kWh thereafter, as against a former charge of 10s. for 22 kWh and 5d. per kWh beyond. Power: Small consumers—a new rate of £5 per kW of maximum demand, plus ¼d. per kWh; large users—the war surcharge of 15 per cent. to be abolished.

Stockton-on-Tees.—WIRING OF SMALL HOUSES.—The Electricity Department is to put into operation an easy-payment scheme of house wiring up to a maximum of £12, repayable in four years by quarterly instalments.

Swadlincote.—ELECTRICITY SUPPLY.—The Urban District Council has passed a resolution consenting to the application of the Burton-on-Trent Corporation for a Special Order to supply electricity within the district. The maximum charges for electricity are not to exceed by more than 1d. per kWh for lighting and 15 per cent. for power the rates charged in Burton.

Tunbridge Wells.—NEW PLANT.—The Town Council is applying for consent to install additional plant at the electricity works at an estimated cost of £29 105, plus £1,534 for contingencies.

West Riding.—The Executive Committee of the Conference of Local Authorities in the West Riding recently met at Bradford to discuss the situation arising from the announcement by the Yorkshire Electric Power Company, Ltd. (reported in the ELECTRICAL REVIEW of June 5th) not to proceed further with its attempt to carry out the scheme of the Electricity Commissioners for the supply of electricity in the West Riding (Aire and Calder) district. The meeting was private, but it was stated that the Committee had decided to seek an interview with the Commissioners before making public any statement on the position, after which a full and considered reply to the Company's announcement would be issued by the conference.

Tramway and Railway Notes.

Birmingham.—YEAR'S WORKING.—The Tramways Committee has issued its report on the year's working of the tramways, railless cars, and motor omnibuses. The total revenue was as follows:—Tramways, £1,428,554, an increase of £91,461 over the previous year; omnibuses, £169,573, an increase of £27,091; and railless-cars £27,845, an advance of £2,425. The number of car-miles run by the trams was over 19 millions, an increase of 1½ millions. On the three services 267 million passengers were carried. To meet the heavy traffic demands it has been decided to purchase 30 additional tramcars (the present number in use is 685), at a cost of £66,000. It is expected that the new cars will be in commission in October.

Cuba.—NEW ELECTRIC RAILWAY.—A company has been formed by local and foreign capitalists for the construction of an electric railway connecting the Bay of Guantanamo with the city of Santiago-de-Cuba. The same syndicate will erect a hydro-electric installation, making use of the waters of the Yateras River, estimated to develop a minimum of 15,000 h.p. —*Reuter's Trade Service* (Habana).

London.—COLLISION AT BAKER STREET.—A collision occurred between two trains at Baker Street station on the Metropolitan Railway on June 14th. An electric locomotive was being shunted from one side of the station to the other when it collided with an incoming train. The locomotive struck the third coach of the train, completely smashing the main part of the body of the coach. Five passengers received treatment at the Middlesex and St. Mary's Hospitals for minor injuries, but were not detained.

Plymouth.—MOTOR-OMNIBUSES.—The Tramways Committee has recommended that the transport service in the borough be augmented by the addition of a further 20 motor omnibuses, and that the engineer be instructed to obtain tenders for the supply of ten of these vehicles immediately. It was stated at a recent meeting of the Council that with one exception no new tramway track had been laid during the past five years. To lay a double track at the present time would cost about £30,000 per mile and, in addition, the sum of £500 per mile per year had to be paid in rates. The tax on the omnibus was only £36 per annum. The profit on the tramways last year amounted to £10,145 and on the 'buses to £3,360.

Salford.—TRACK RENEWALS.—With a view to providing work for the unemployed, the Corporation is to relay the tramway track in Blackfriars Road between Chapel Street and Broughton Bridge, at an estimated cost of £11,500, and in Great Cheetham Street West from Great Clowes Street to Bury New Road, at an estimated cost of £3,700.

Southern Railway Electrification.—Tests were commenced on June 8th of the first trains to run on the newly-electrified part of the South-Eastern section of the Southern Railway. The run from Sydenham, *via* Catford, to Ravensbourne took 26 minutes, as did that from St. Paul's to Ravensbourne. Each of the 21 trains forming the service will be tested in turn until the opening, which will probably be July 12th.

Telegraph and Telephone Notes.

Greece.—MARCONI'S PROPOSAL REJECTED.—The Greek National Assembly has rejected the proposed agreement with the Marconi Co. concerning the establishment of radio stations in Greece.—*Financial News.*

Imperial Wireless Committee.—DOMINION REPRESENTATIVES.—The Postmaster-General, in a written reply to Sir Harry Brittain, states that the following members have been nominated to the Imperial Wireless Committee:—

Australia.—Sir Joseph Cook, High Commissioner, and Mr. F. W. Mason Allard, chairman of Amalgamated Wireless of Australasia, Ltd.

Canada.—Mr. Lucien Pacaud, secretary to the High Commissioner, and Mr. Henry W. Allen, director of the Marconi Wireless Telegraph Co. of Canada.

India.—Mr. J. G. P. Cameron of the Indian Telegraph Department, and Mr. Nigel F. Paton, representing the Indian Radio Telegraph Co.

New Zealand.—Sir James Allen, High Commissioner, and Mr. John Millward, late manager in the Pacific of the Pacific Cable Board.

South Africa.—Mr. J. S. Smit, High Commissioner, and Mr. H. E. Penrose, representing the South African Wireless Telegraph Co. Colonel E. A. Sturman, Postmaster-General of the Union of South Africa, will also attend the Committee while he is in this country.

The Committee will hold its first meeting on June 22rd.

International Convention for Safety of Life at Sea.—An international convention has been issued providing that the provisions of the Merchant Shipping (Convention) Act, 1914, shall be postponed from coming into operation until the first day of January, 1926.

Ireland.—RADIO STATION DISMANTLED.—The Marconi radio telegraph station at Clifden is to be dismantled, and has been sold to Messrs. Thomas W. Ward, Ltd., of Sheffield, for that purpose. This station has played a leading part in the development of commercial radio communication; it was the first station to have regular communication with America, on a wavelength of 7,000 metres. The erection of the 3,000 ft.-high steel masts was considered a notable engineering feat at the time; the plant and equipment has now become out-of-date.

Japan.—NAVAL RADIO TRANSMITTER.—The International General Electric Co. has received an order from the Japanese Government for an 80-kW vacuum-tube radio transmitter for use in communication between Japanese naval stations. It is designed to operate on frequencies between 15,000 and 43,000

cycles, with a maximum efficiency at 24,000 cycles (12,500 metres).

New Telephone Lines.—The laying of long-distance underground telephone cables between Tokio and Okayama will cost 30,000,000 yen. The distance is over 467 miles. The Tokio-Osaka line will be completed in 1927, and the Osaka-Okayama line in 1929, while the Nagoya-Kyoto line will be connected in June, and Nagoya-Osaka line in September this year. From these trunk cables will be extended to Kyushu in the west and Hokkaido in the north in the future.—*Eastern Engineering.*

Newfoundland.—Radio Station for Sale.—The British Admiralty has offered for sale by public auction the large radio station near St. Johns, built during the war at a cost of £40,000 for assisting and directing the movements of the Allied warships in the western sections of the North Atlantic. Rapid development has rendered the equipment more or less obsolete, and for the past three or four years it has not been working at all. The Admiralty two years ago offered it to the Newfoundland Government, but the offer was declined, as the Government found that it could not be made commercially available without very heavy outlay, and now it is to be sold either as a whole or piecemeal, says the *Daily Mail.* Advertisements have been circulated in the United States and Canada with a view to attracting the attention of possible buyers.

Panama.—New Telegraph System.—In order to facilitate the dispatch of vessels through the Panama Canal, a printing system of nine sets of Kleinschmidt telegraph typewriters has been installed at Balboa and Cristobal and at the Gatun, Pedro Miguel, and Miraflores locks, says *T. & T. Age.* Prior to the installation of these machines, orders governing the dispatch of ships and messages relating to their various requirements were transmitted by telephone.

Submarine Cable Association.—International Body.—The names of the undertakings at present embodied in the International Cable Companies' Association, the formation of which was reported in February last, are given by the *Financial Times* as follows:—

Eastern Telegraph, Eastern Extension, Australasia and China Telegraph, Western Telegraph, Indo-European Telegraph Companies, all of London.

Commercial Cable and Western Union Telegraph, New York.

Great Northern Telegraph, Copenhagen.

Compagnie Française de Cables Telegraphiques, Paris.

Deutsche Atlantische Telegrafengesellschaft, Berlin.

The Association is at present engaged chiefly in considering the proposals which have been put forward by various Government Administrations for discussion at the International Telegraph Conference, which is to open in Paris on September 1st next. It is the practice in some Continental countries for the Government Administration to collect and deliver telegrams, and they are not quite satisfied with the charges. In particular, they propose that there be an increase of 50 per cent. on code messages. It is argued that users of the telegraph services invariably employ the maximum number of ten letters when employing code, as opposed to the average of six letters in plain language. Code messages, owing to the use of awkward words, are not so easily dealt with as "plain" messages, and so various Administrations are seeking the increase mentioned. The proposals emanate entirely from Government authorities and not from the cable companies. Code users are the best customers of the companies, and the latter are not anxious that any increase should be made.

The Telephone Service.—Deposit Reduced.—It is reported that the minimum deposit required from telephone subscribers in respect of fees and charges has been reduced from £1 10s. to £1.

Radio Notes.

Aerials.—Power of Prohibition.—The Bath Corporation Bill was again before the Local Legislation Committee in the House of Commons on June 11th. Discussion took place concerning a clause empowering the Corporation to regulate the fixing of aerials across public streets, and Sir E. Holderness, representing the Home Office, while not opposing the clause, pointed out that the matter was dealt with in the general public health Bill now engaging the attention of the House of Commons, and in the circumstances, it might be desirable to delay the question so that Bath might come within the scope of the general law. Mr. Villiers Bayley, for the Corporation, said the general Act might not pass in its present form, and Bath was anxious that the opportunity should not be lost for dealing with what was a real danger. In Bath there were many narrow streets with electrical conductors overhead for tramways, and it was regarded as essential that the Corporation should have the power to regulate and, if need be, to prohibit the erection of aerials over such streets. The chairman said the view of the Committee was that public safety should be the first consideration, and that the Corporation should have the powers for which it asked.

Java.—It is reported that many applications for permission to erect broadcasting stations have been received by the Government. The latter, however, will probably reserve all rights to itself as a monopoly.

Radio in Schools.—Loud-speaker Tests.—At a meeting at Plymouth on Friday last week of the Educational Advisory Committee on radio transmission to schools, it was decided to hold a demonstration in September, at which traders and others will be invited to test loud speaker sets with a view to discovering the most suitable for school purposes.

Rumania.—New Radio Company.—It is announced from Bucharest that the Roumanian law authorising the introduction of a wireless service will come into operation in September, the law providing for the formation of a company with Roumanian capital. It is proposed to permit the importation of wireless apparatus and constituent parts to any desired extent, and the idea is to import from Germany, France, Italy, and Austria.

Switzerland.—Broadcasting.—Since the Geneva, Lausanne, and Zurich broadcasting stations began their service, the number of receiving sets in Switzerland has increased by nearly 16,000, says *The Times.* There were only three registered receiving sets in 1911. In 1923 the number rose to 960, and at the end of last year to 16,964, exclusive of private sets which have not been registered. The Swiss Federal Post and Telegraph Office controls private receiving sets, and theoretically no individual is allowed to have a set unless it is registered. Moreover, individuals sign a promise to the effect that they will permit the Federal controllers to inspect their sets at any time.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—Sydney.—August 5th. New South Wales Railway Commissioners. Two ash conveyors for the White Bay power house.

September 9th. One electric travelling jib crane and maintenance for 12 months. (A.X. 2,120.)*

Acton.—June 26th. Corporation. Steam engine and dynamo for the Public Baths. (June 12th.)

Aylesbury.—Electricity Works. One 400-kW rotary converter. (June 12th.)

Belgium.—June 24th. The 3me General Direction of the Ministry of National Defence, 10, Rue de Méridien, Brussels. Supply of wire and rubber-insulated cables for the Régiment des Troupes de Transmission. Particulars (Cahier des Charges Special No. 556) for ¾ fr.

June 29th. Portable accumulators. (Special No. 558), particulars 7½ fr.

Bishopstoke.—June 27th. Hants. County Council. Electric light installation, tuberculosis sanitarium. Mr. A. L. Roberts county architect, The Castle, Winchester. (Returnable deposit of £1 1s.)

Canterbury.—June 22nd. Electricity works. L.p. lead-covered and armoured cables. (June 12th.)

Darlington.—June 30th. Electricity Department. One 6,000-kW turbo-alternator, condensing plant, and two 40,000-lb. per hour water-tube boilers. (June 5th.)

Eccles.—June 29th. Electricity Committee. One 1,300-kVA Scott-connected transformer group. (June 5th.)

Egypt.—Cairo.—Inspecting Engineer to the Egyptian and Sudanese Governments, Queen Anne's Chambers, London, S.W. 24,350 kilos copper wire and rods.

July 9th. Director of the Section of Local Municipalities and Commissions (Savoy House), Cairo. Supply and installation of an electrical system at Zifta.—*Reuter's Trade Service* (Cairo).

Fife.—July 6th. Education Authority. Electric lighting work in connection with the addition to Leslie Public School. Schedules from Master of Works, Fife Education Authority, Kirkcaldy.

Fleetwood.—June 22nd. Electricity Department. One water-tube boiler, superheater and mechanical stoker. (June 12th.)

Glasgow.—June 22nd. Corporation. Electric lighting work at the Public Baths, George Street, Whiteinch. Specifications, &c., from Office of Public Works, City Chambers.

Grimsby.—June 29th. Electricity Department. Cooling tower superstructure and pipework. (June 12th.)

July 4th. Electricity Department. 15,000 yd. p.i.l.c. l.p. cables. (See this issue.)

Huddersfield.—June 25th. Town Council. Electrician's work in connection with the erection of 42 houses (9 blocks), New Street, Laund Road, Salendine Nook. Particulars and form of tender from Borough Architect, 26, Ramsden Street, Huddersfield.

Keighley.—June 26th. Electric lighting installation at the new electro-medical block at the Keighley Victoria Hospital. Particulars from Miss M. Hoyle, secretary, Victoria Hospital, Keighley.

Littleborough.—July 8th. Urban District Council. 6,600-V cables, roadwork, &c., transformer, switchgear, and cable connections for new sub-station. (See this issue.)

London.—STEPNEY.—June 24th. Board of Guardians. Electrically-driven lift and building work in connection with it. (June 5th.)

LONDON COUNTY COUNCIL.—June 25th. Wiring and fitting for electric lighting five blocks of flats on the East Hill estate. (June 12th.)

June 29th. Electric lighting installation at Holcroft Road School, Hackney. (June 12th.)

METROPOLITAN ASYLUMS BOARD.—June 22nd. Installation of electric lighting at Highwood Hospital, Brentwood. (June 12th.)

H.M. OFFICE OF WORKS.—July 3rd. Supply of mechanical and electrical engineering labour in the Manchester district during a period of three years from August, 1925. (See this issue.)

BATTERSEA.—July 21st. Electricity Department. One 10,000-kW turbo-alternator, with condensing plant, switchgear, two 65,000-lb. per hour boilers, with pipework and ash-handling plant. (See this issue.)

Manchester.—July 1st. Electricity Committee. Twelve months' supply of electricity meters, potential and current transformers, time switches, and 3-pint electric kettles. (See this issue.)

June 22nd. Tramways Committee. Permanent-way special trackwork. Specifications from Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—July 21st. Public Works Department. Two electrically-operated water-level indicators.*

Normanton.—June 27th. Electric lighting installation at the Boys' Grammar School. Specifications from Mr. T. R. Robinson, Clerk to Governors, Technical School, Normanton.

Paisley.—June 22nd. Renfrewshire Education Authority. Electric lighting installation for two new buildings at Paisley schools. Schedules from Master of Works, Paisley.

Rochdale.—July 1st. Borough Council. Electrification of sludge-pressing machinery, Roch Mills sewage disposal works. Supply of electrically-driven air compressor. Particulars from Mr. S. H. Morgan, borough engineer, Town Hall.

Salford.—June 29th. Board of Guardians. Supply and erection of electrical massage and X-ray apparatus at Union Infirmary, Hope, Pendleton. Particulars from Mr. E. H. Inchley, clerk to the Board of Guardians, Poor Law Offices, Eccles New Road.

Stoke-on-Trent.—July 7th. Electricity Supply Department. Two 25-kVA transformers and electrically-driven grab crane. (See this issue.)

South Africa.—CAPE TOWN.—July 22nd. Electricity Department. Pumping equipment: Two motor-driven pumps, switchgear, &c. (A.X. 2,086.)*

Thirsk.—July 14th. Electricians' work required in erection of Thirsk and Sowerby Institute. Particulars from Mr. C. Lee, Millgate, Thirsk.

Tunbridge Wells.—July 8th. Electricity Committee. One 3,000-kW turbo-alternator, with condenser, piping, and cables, one cooling tower, steam piping, &c. (June 5th.)

Uruguay.—MONTEVIDEO.—July 28th. State Electricity Supply Works. 15 equipments (switchboard, feeder cubicle, &c.) for transformer sub-stations.*

Warrington.—June 23rd. Electricity and Tramways Committee. L.p. paper-insulated lead-covered cables. (June 12th.)

Winchester.—July 10th. Electricity Department. One 1,250-kW. d.c. geared turbo-generating set, with condensing plant, &c. (June 12th.)

Worksop.—June 27th. Electricity Department. Two Diesel or semi-Diesel engines, direct coupled to two 300-kW d.c. generators; engine room extension; overhead travelling crane; oil storage tanks and pumps. (June 12th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.—City Council. Accepted:—

Distribution transformers (£21,840).—Electrical Plant Manufacturers, Ltd.
H.p. underground cables (£23,767).—W. T. Henley's Telegraph Works Co., Ltd.
Maximum demand indicators.—W. G. Watson & Co. (£1,330); Australian General Electric Co., Ltd. (£472).
Meter parts, wheels, worms, and pinions.—Electricity Meter Manufacturing Co., Ltd. (£1,219); Noyes Bros. (£218).

The contract for the whole of the electrical control gear required in connection with the Sydney Harbour bridge has been placed with Messrs. Allen West & Co., Ltd.—*Tenders.*

Barnes.—Electricity Committee. Accepted:—

Half a mile of cable (£360).—Macintosh Cable Co., Ltd.

Bentley.—Urban Council. Accepted:—

Electrical fittings for the Bentley House Farm site houses (£374).—F. B. Thorpe.

Caerphilly.—Urban District Council. Accepted:—

Transformers.—Yorkshire Electric Transformer Co., Ltd.

Carlisle.—Electricity Committee. Accepted: —

Two rotary feed pumps (£1,057).—G. & J. Weir, Ltd.

Dorchester.—Electricity Committee. Recommended:—

Campbell gas engine, direct-coupled dynamo, open-hearth gas producer and cooling apparatus (£6,633).—Campbell Gas Engine Co., Ltd.
10-ton travelling crane (£282).—Herbert Morris, Ltd.
Extension of switchboard panel (£168).—General Electric Co., Ltd.

East Preston.—Board of Guardians. Accepted:—

Electric wiring and fittings, with solid-drawn steel tubing (£110).—H. J. Cash & Co.

Glasgow.—Tramways Committee. Recommended:—

Insulated bolts.—Birkbys, Ltd.
D.c.c. wire.—London Electric Wire Co. & Smiths, Ltd.

Electricity Committee. Cables, meters and carbons for 12 months. Recommended:—

L.p. cables.—Callender's Cable & Construction Co., Ltd.; Enfield Cable Works, Ltd.
H.p. cables.—Callender's Cable & Construction Co., Ltd.; W. T. Glover and Co., Ltd.
I.R. cables and flexibles.—Craigpark Electric Cable Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd.; Edison Swan Electric Co., Ltd.; Elkay Electrical Manufacturing Co., Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Arc lamp carbons.—Beacon Carbons, Ltd.; General Electric Co., Ltd.

The Watch and Lighting Committee has received a communication from Simplex Conduits Ltd., stating that, owing to a clerical error, the price for cab-tire-sheathed cable was quoted as 80s. 6d. per 100 yards instead of 85s.; the firm ask to be either relieved of the contract as regards that item or be allowed to supply the materials at the revised price.

The Committee has agreed to the relief asked for, and has accepted the offer of Messrs. W. Brown & Co., at 85s. per 100 yd. for the cab-tire-sheathed cable.

Gravesend.—Electricity Committee. Accepted:—

Storage battery repairs (£300).—Tudor Accumulator Co., Ltd.

Hull.—

Electrical installation at the new premises of the *Daily Mail and Hull Times*, Ltd., Chameson Street.—C. F. Pardoe.

Haworth.—Urban District Council. Accepted:—

Transformers.—Yorkshire Electric Transformer Co., Ltd.
L.p. cables.—Western Electric Co., Ltd.
E.h.p. and l.p. switchgear.—Metropolitan-Vickers Electrical Co., Ltd.

London.—STOKE NEWINGTON.—Electricity Committee. Recommended:—

Cables for 12 months.—W. T. Henley's Telegraph Works Co., Ltd.
Meters (up to 10 Ah) for 12 months.—Reason Mfg. Co., Ltd.

SHOREDITCH.—Lighting Committee. Electrical installation at Archer House, Ware Street area, in accordance with the agreement to be entered into with the Housing Department of the London County Council:—

Toy & Winslow	£1,140
H. J. Cash & Co.	881
Malcolm & Allen, Ltd.	878
Electrical Installations, Ltd. (Recommended)	682

Manchester.—Education Committee. Accepted:—

Electric lighting installations: Alma Park school.—Seddon & Sons. Peacock Street school.—J. W. France.

Ossett.—Corporation. Accepted:—

Electric lighting installation at Town Hall (£199).—C. Taylor & Co.

Stalybridge.—Stalybridge, Hyde, Mossley, and Dukinfield Joint Board.

Main switchgear (metal-clad vertical drop-down type).—Ferguson, Pailin, Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted:—

Water tower and tanks in connection with extensions at Central power house (£1,900).—T. Godwin & Son.
Pipework and chlorinating plant (£3,855).—G. H. York & Co.

Housing Committee. Accepted:—

Wiring houses in Scotia Road (£491).—Barnett & Soans.

Health Committee. Accepted:—

Electric wiring at Burslem salvage works.—E. M. Evans & Sons, Ltd.

Sutton Coldfield. — Electricity Committee. Recommended:—

L.p. feeder and extension of existing feeder (£2,209).—Callender's Cable and Construction Co., Ltd.
Booster and switchgear (£1,146).—General Electric Co., Ltd.

Swansea.—Electricity Committee. Accepted:—

Telephones from office to works (£134).—Dictograph Telephones, Ltd.

Tynemouth.—Electricity Committee. Accepted:—

Cable.—Macintosh Cable Co., Ltd.; Western Electric Co., Ltd.; Hackbridge Cable Co., Ltd.

Wakefield.—Markets Committee. Accepted:—

Installation of electric light on five rows of stalls.—Stephen Jubb, Ltd.

Electricity Committee. Accepted:—

1,000-h.p., 3-phase motor (£1,544).—Metropolitan-Vickers Electrical Co., Ltd.

Weymouth.—Electricity Committee. Accepted: —

500 yd. cable (£233).—Johnson & Phillips, Ltd.

Wolverhampton.—Education Committee. Accepted:—

Installation of electric lighting and power in the engineering and technological block of the new Technical College (£1,270).—Smith and Bellhouse.

Consequent on the gift of the main switchboard and the distribution board by Cable Accessories, Ltd., the above amount will be subject to a deduction of £176.

THE vi
tion of
occasio
accoun
afforde
leading
compar
conduc
Witton
followi
given.

The W

The
Witton
of fact
the ma
and ap
form b
centres
Ltd., f
the lar
concern
Apart
may b
Chalme
lamp
Peel-C
Covent
ton, th

and B
metal,

ham, t
last, bu
laborat

Works Visited by the I.E.E.

THE visit of a large party of members of the Institution of Electrical Engineers to the Midlands, on the occasion of the Summer Meeting (of which we give an account elsewhere in this issue) afforded an opportunity to the two leading electrical manufacturing companies to welcome them and to conduct them over their factories at Witton and Rugby, of which in the following pages some particulars are given.

The Witton Works of the General Electric Co., Ltd.

The G.E.C. engineering works at Witton are one of the largest groups of factories in the world levoted to the manufacture of electrical plant and appliances. Nevertheless, they form but one of the manufacturing centres of the General Electric Co., Ltd., for the company claims to be the largest electrical manufacturing concern in the British Empire. Apart from those at Witton, mention may be made of the Fraser and Chalmers works at Erith, the Osram lamp works at Hammersmith, the Peel-Conner telephone works at Coventry, the Pirelli-General cable works at Southampton, the instrument works at Salford, the Chamberlain and Hookham meter works at Birmingham, the art metal, and cooking and heating works, also in Birmingham, the glass works at Lemington and Wembley, and last, but far from least, the company's extensive research laboratories at Wembley. It is in the Fraser and Chalmers works that heavy mechanical plant is made which is complementary to the heavy electrical plant built at Witton. The principal individual factories at Witton comprise the main engineering works, switchgear works, standard motor works, small motor and fan works, transformer works, carbon works, battery works, lamp black works, moulded insulation works, tool and hoist works, a foundry, and the development department. Of the total estate of 120 acres, the works and offices occupy about 35 acres; there are upwards of 4,000 employés.

Fig. 3.—Standard Motor Works, Main Assembly Bay.

Fig. 1.—G.E.C. Main Engineering Works, Witton: South Bay.

The main engineering works consist of 450-ft. bays, one of which is shown in fig. 1; the machine tools have been designed for dealing with stator frame and rotor forgings up to nearly 50 tons in weight. An example is a lathe used chiefly for turning from the rough solid steel rotor forgings; the length of its bedplate is 38 ft., and it is capable of accommodating between centres a length of 26 ft., and swinging a diameter of 56 in. The weight of the tool is 40 tons, and it is driven by a 75-h.p. "Witton" motor. Other machines are a plane milling machine for cutting the slots in solid rotors of turbo-alternators, which is capable of operating upon rotors over 50 tons in weight, and a mill designed for boring turbo-alternator shells. The weight of this mill complete is 72 tons; its founda-

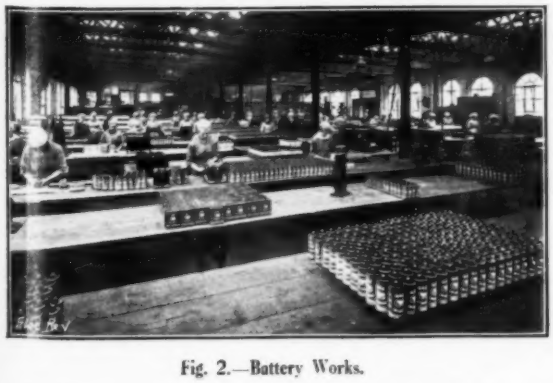


Fig. 2.—Battery Works.

Fig. 4.—Fan Works: A Silence Test Cabin.

tions were specially prepared for access to the self-aligning bearing of the table, and it will accommodate parts 12 ft. 6 in. in diameter, and 9 ft. 6 in. deep.

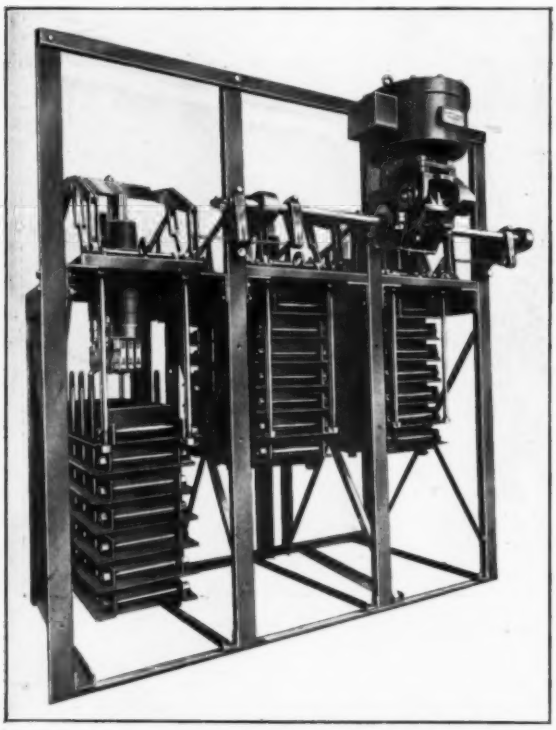


Fig. 5.—Electrically-operated Oil Circuit Breaker, 800,000 kVA.

Fig. 6.—Carbon Works: The Ovens.

In this bay there were seen parts for two 22,500-kVA machines for the Corporation's Nechells station, in which three similar sets have already been installed, in addition to one of two 12,500-kVA, 3,000-r.p.m. machines ordered by the Sunderland Corporation; other orders in hand included sets of the same size for Portsmouth, Poplar and Southampton Corporations. In the other bays a range of machine tools is available for dealing with parts of low-speed generators, colliery winders, rolling-mill motors and the like, without having recourse to the tools in the turbine bay. Amongst the large electrical machines seen was a reversible rolling-mill motor (fig. 8), with a maximum output of 18,000 h.p., for Messrs. Baldwin, Ltd., of Swansea: also several traction rotaries of 1,500 and 2,000 kW, forming parts of contracts for the Southern Railway and the South African Government railways. The switchgear works cover an area of 100,000 sq. ft., exclusive of offices, and the range of switchgear manufactured is comprehensive; an example of e.h.p. remote-controlled cubicle gear is shown in fig. 5. A complete outdoor sub-station has been built on a site outside the switchgear works.

The standard motor works are laid out for the rapid production of industrial motors of from about 5 to 200 h.p. The G.E.C. is rapidly developing the traction side of its business; recently a large number of coaches were equipped for the Southern Railway, and in the works at present are several motors for a contract for the London Electric Railways.

The small motor and fan works comprise some ten bays, and on all assembly benches several small switchboards are provided so that at stages during manufacture the various parts may be tested. Of interest is the group of "silence" test cabins (fig. 4), so equipped that a large number of fans may be run simultaneously.

In connection with the transformer works, considerable experimental work has been carried out in the development department with oil, and a purifying plant forms an essential item of the equipment.

Before the war the combined Admiralty and War Office demand for carbons for searchlights amounted to 150,000 per annum; during the period of hostilities the Witton carbon works, fig. 6, provided over 5,000,000 searchlight carbons for Government use, and approximately 7,000,000 arc-lamp carbons for dock and yard lighting and similar purposes, a total of 12,000,000 pieces. Large consignments of searchlight carbons were also supplied to our Allies.

The battery works are engaged in the manufacture of porous pots, "Carsak" batteries, dry and inert cells, and wireless batteries, including the new "Gecophone" super h.p. batteries. The output of this factory has been practically trebled in the past five years.

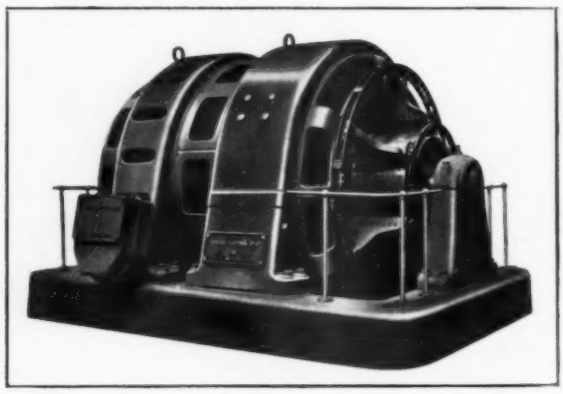


Fig. 7.—1,000-kW G.E.C. Two-bearing Motor Converter.

A recent addition to the Witton group of factories is the moulded insulation works, equipped for the production of moulded "Wittonite" and "Bakelite."

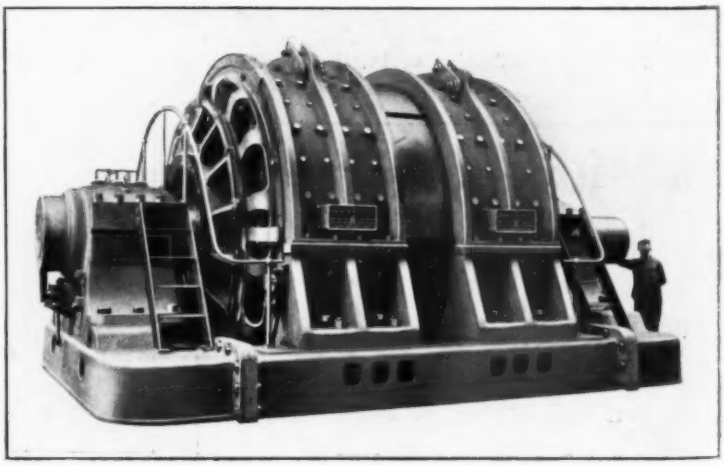


Fig. 8.—18,000-h.p. D.C. "Witton" Reversing Mill Motor.

The works power house contains two 1,500-kW G.E.C.-

Fraser & Chalmers turbo-alternators, a 500-kW d.c. turbo-generator driven through gearing, and three 750-kW rotary converters.

The foundry is two acres in area, and is one of the largest of its kind in the Midlands. It is capable of producing practically the whole of the castings required in the various works, from the stator of a 20,000-kW turbo-alternator weighing over 50 tons, to the smallest castings used in fractional h.p. motors, &c.

Many practical manufacturing problems are continually arising which call for immediate solution. These are referred to the Development Department, a large proportion of the ground floor of which is devoted to a workshop equipped with a full complement of machine tools. An electrical laboratory adjoins, and contains a wide range of testing and measuring instruments. The biased system of protection (McColl patents) was demonstrated, and in the mechanical laboratory tensile tests upon high-temperature metals were made.

The Magnet Club building is one of the finest of its kind in the country. The spacious main hall in which luncheon was served to the visitors on the occasion of the works visit was transformed into a ballroom for the dance and entertainment on the Thursday evening.

The Rugby Works of the British Thomson-Houston Co., Ltd.

On Thursday, June 11th, the Institution of Electrical Engineers' Summer Meeting visited the extensive Rugby works of the British Thomson-Houston Co., Ltd.

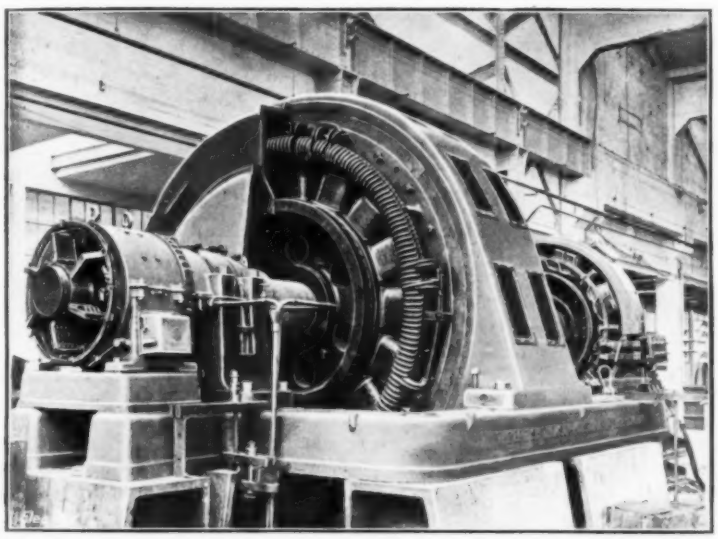


Fig. 1.—B.T.-H. 10,250-kVA Alternator (one of seven).

The various departments of the works, which occupy an area of over 90 acres, are arranged about a central avenue, on the north side of which is situated the turbine department, fig. 2, which consists of a main building 1,000 ft. long, with smaller bays on either side. This department has been designed to approximate as closely as possible to the unidirectional flow of material through the premises. The equipment in this branch of the works is capable of dealing with material for turbines and generators of any size which the railways of the country are capable of handling.

The assembling of and lining-out operations on turbo-generators are effected at the north end of the main bay, where the completed rotors for both turbines and alternators are given dynamic balancing tests on special machines. There are two of these machines, the smaller of which is capable of balancing rotors up to two tons in weight, and the larger one up to twenty tons. Completed machines are tested in the centre of the main bay on bases provided with condensers capable of dealing with 35,000 to 40,000 lb. of steam per hour. Steam is available at pressures up to 250 lb. per sq. in., and a separately fired superheater places superheat up to 750 deg. F. at the disposal of the testing engineers.

The winding of generator coils, the machining of small parts and blades for turbine wheels, and the fixing of the blades on the disks, are carried out in the smaller bays. The north end of the main bay is also the scene of the stator and rotor winding operations, and a complete impregnating installation is on site. Among the machines at present passing through this department are:—One 18,000-kW, two 5,000-kW, one 3,000-kW, and two 1,500-kW turbo-alternators, and a 25,000 cu.-ft. per minute turbo-compressor.

A machine shop where traction motors and medium-size generators and motors are turned out adjoins the turbine department. The

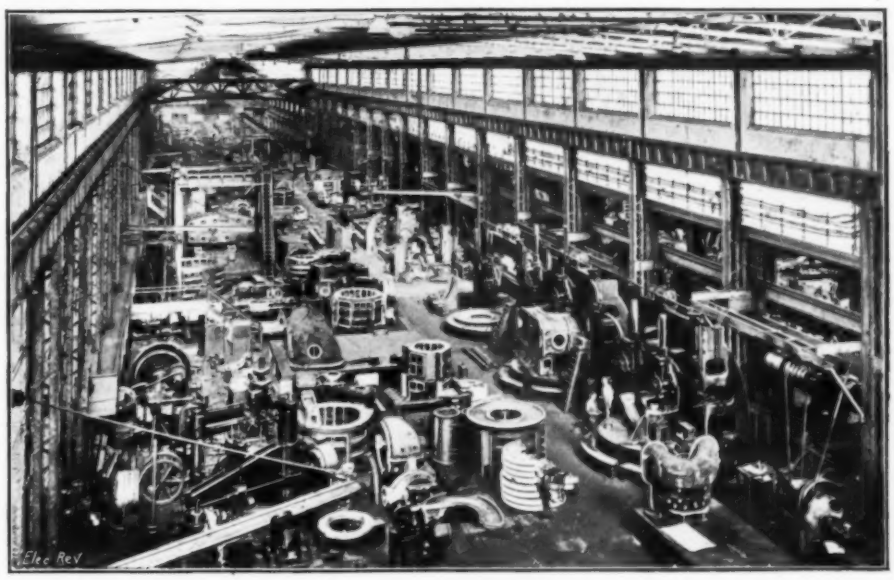


Fig. 2.—Turbine Machine Shop, South End.

traction motors, which are of the interpole parallel ventilated type, are made in sizes from 30 to 300 h.p., for pressures up to 1,500 V. Polyphase commutator

variable speed motors are also made in this shop. The paper-making, printing and textile industries offer wide fields for these motors. The speed variation is obtained by movement of the brush system.

A similar building to the turbine premises is next to the latter; here, rotary converters, motor converters and motor generators are manufactured (fig. 4). The lay-out of the machinery in this department is on the same lines as that of the turbine factory.

A 2,160-h.p. induction motor winder, believed to be the largest geared induction motor winder in the world, was made in this section of the B.T.-H. works for South Africa. Two large Ward-Leonard Ilgner winders, made for the Bolsover Colliery Company, which have recently been completed and are ready for dispatch, are for a new "all electric" colliery which is being put down in the Sherwood Forest; the motor for each winder will give a continuous output of 2,160 h.p. The a.c. supply will be converted to d.c. at 650 V by means of large motor-generator sets with direct coupled flywheels to equalise the demand from the a.c. mains. A 20,500-h.p. motor, probably the largest reversing mill motor in the world, which develops 2,700,000 ft.-lb. torque, is a notable example of the products from this building. Another interesting equipment recently supplied comprises an induction motor normally rated at 650 h.p., which, running at 365 r.p.m., drives a reversing mill for heavy copper and brass slabs. The motor is reversed by a master controller from full speed in one direction to full speed in the other direction during a period of only 11 seconds.

Some rotary converters, remaining from orders for large numbers in connection with the Southern Railway electrification schemes, are now being completed. The largest motor-converter now in operation has also been built by this company. It runs at 428 r.p.m. and is rated at 2,500 kW, with the standard overload capacity.

Building No. 25 is a most important and very interesting part of the Rugby works. It is here that automatic and non-automatic control equipment of every description and for every service is made, the three upper of the four floors being used for this purpose. The products of this branch include completed individual automatic sub-station equipments, in units from 250 to 4,500 kW, for working at pressures of from 400 to 3,000 V d.c. These comprise single rotary converters, two rotary converters in series, and synchronous motor-generator sets. They operate on three-wire power and lighting loads and on traction loads. Separate excitation during starting (whereby the correct polarity is obtained), the use of a robust motor-operated controller for fixing the sequence of switching, and the use of protective devices which operate on the principle of opening the circuit, are features of the B.T.-H. scheme of control for these equipments. Distant control apparatus and devices for the control of mercury-arc rectifiers are other products of this section. Traction equipment in-

Fig. 5.—B.T.-H. Lamp Works: Stem Machine and Filament Mounting Room.

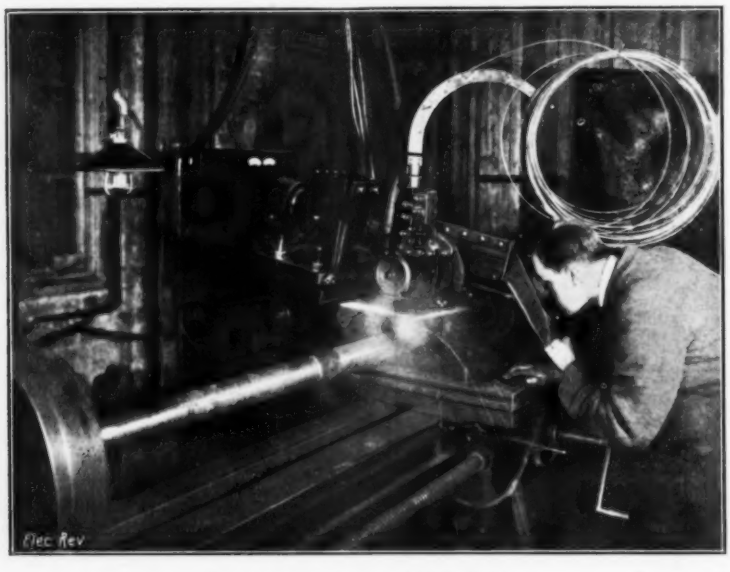


Fig. 3.—Automatic Arc Welding Machine.

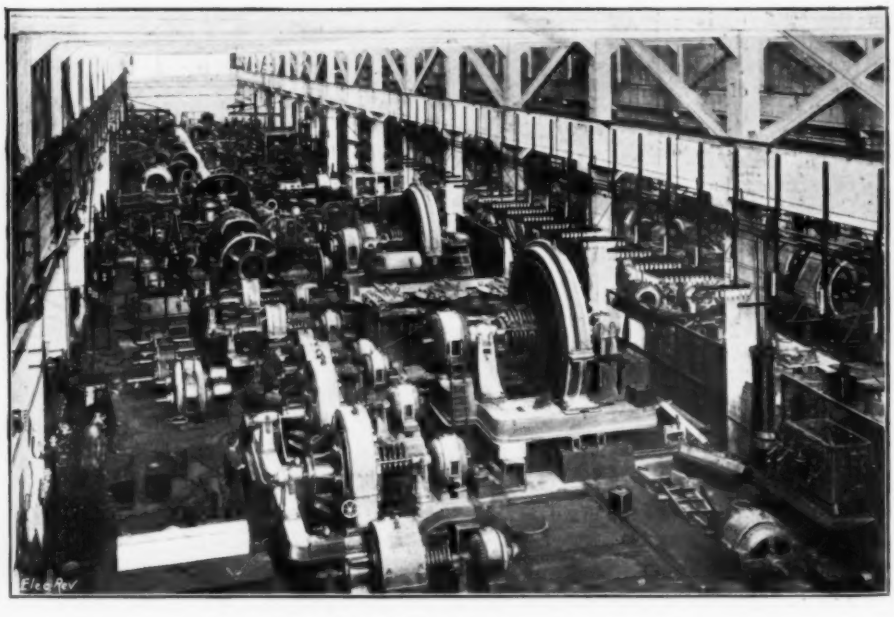


Fig. 4.—B.T.-H. 4,500-kW Rotary Converters under Test.

clud
cars
oper
tive
3,00
with
is p
is

floo
turn
and
mak
mod

ener
powe
and
h.p.
Elect

Co. i
enter
techn
accor
partn
works
perio
cours
engin
tices.

Car
fire s
for t
are e
playi

A

We ar
Hotel,
Protect
Wirele
by Mr
tion, L
dum h
recogni
utmost
ten poi

1.—(a)
nar
the
def

2.—All
be

3.—Me
the
to

4.—To
affa
den

5.—Not
Ass
ma
sat
set

6.—The
liq
of t

7.—Lim
the
ass
rec

8.—

9.—I
pre
all
not

10.—An
me

Mr

clude complete control gear for tramway and railway cars by means of manual, magnetic, or pneumatic operation. Other traction devices are overload protective apparatus capable of breaking up to 3,000 A at 3,000 V in 0.001 second. Special equipment to comply with Lloyds' and other regulations for ship propulsion, is part of the control gear for use on board ship which is manufactured on these floors.

The foundry is arranged in three floors. The ground floor is equipped with the most modern appliances for turning out heavy castings up to about 100 tons each, and the first and second floors are devoted to the making of small castings, many of which are machine moulded in large quantities.

The works is supplied throughout with electrical energy obtained from the company's own 4,000-kW power station, which is equipped with generating plant, and converting plant for dealing with an additional h.p. supply from the Warwickshire and Leicestershire Electric Power Co.

An apprentice training scheme adopted by the B.T.-H. Co. is worthy of note. Premium apprentices are not entertained, but boys are taken from elementary schools, technical colleges, and universities, for training in accordance with special courses. An "Apprentice Department," which has a qualified staff and well-equipped workshops, takes charge of each boy during the whole period of his apprenticeship. There are three principal courses of training, one for trade apprentices, one for engineering apprentices, and one for student apprentices.

Canteens, dining rooms, rest rooms, ambulance and fire stations, &c., are provided throughout the works for the use of employés; and all members of the firm are encouraged to take part in various sports, excellent playing fields being situated near at hand.

An Association to Watch over Radio Trade Matters.

Ten Points.

WE are asked to state that at a meeting held at Anderton's Hotel, E.C., on June 9th, in connection with a proposed Trade Protection Association for the Manufacturing and Wholesale Wireless Industry, a scheme was placed before the gathering by Mr. S. W. Taylor of the British United Traders' Association, Ltd., 5, High Holborn, W.C., who presided. A memorandum headed "Ten Points" was fully discussed, as it was recognised that the suggestions contained therein were of the utmost importance. It was unanimously decided to adopt the ten points in their entirety as follows:—

1.—(*a*) Each member to acquaint the Association with the names and addresses of all customers who have exceeded the terms of credit; (*b*) The Association to record such defaulters.
2.—All County Court judgments and other detrimental acts to be recorded by the Association.
3.—Members to be advised to make status inquiries through the Association, the information so obtained to be added to the trader's record in the Association's registers.
4.—To ensure as complete a record as possible of the trader's affairs, it is suggested that members' overdue accounts be dealt with by the Association.
5.—Notices of meetings of creditors, &c., to be notified to the Association so that an independent investigation can be made and if the matter is of a fraudulent or doubtful nature, the Association's executive to decide the course of action to adopt.
6.—The Association proposes to have three departments:—Inquiry, Debt and Investigations. The combined records of the three departments will be of value to the member.
7.—Limited companies who seek credit to be "looked up" and the actual cash received by the company to be recorded, also inquiries to be made with regard to the directors connected with the company if considered advisable.
8.—A "Cautionary List" to be issued to members each week.
9.—If members co-operate on the lines suggested a most comprehensive record will eventually materialise in respect of all persons or firms who come under the Association's notice.
10.—Any matter considered as appertaining to the advancement of the industry to be taken up by the Association.

Mr. W. J. McLeod, of Messrs. McLeod & McLeod, raised the question of the classification of customers or prospective customers into categories, commensurate with the financial standing of each individual, the category to be distinguished by a letter, to denote the safety mark of credit. For example, firms of recognised repute would come under category "A," representing unlimited credit, firms of lesser repute "B" category with a generous limit to credit, and so on. There would probably be four or five categories, each carefully graded. After careful consideration and discussion it was unanimously agreed to incorporate the proposal in the Association's general scheme, which is directed at casting a net around the undesirable trader.

Other points with regard to the working of the Association were then discussed and explained by the chairman, and it was unanimously agreed that the Association should function immediately. To help forward the work of the Association in compiling the necessary records of traders, it was proposed by Mr. W. J. McLeod (McLeod & McLeod) and seconded by Mr. J. Cruwys (Power Equipment Co., Ltd.), that all firms becoming members of the Association should be asked to supply to the Association the names of all their customers with remarks at the side of each showing the limit of credit allowed. This was agreed to without dissent as being a vital part of the category system.

(With regard to this matter, Mr. Taylor asks us to state, in order to avoid any misunderstanding that the information supplied to the Association is for recording purposes only; no information respecting any firm's customers will be divulged on any pretext whatsoever to any other firm or member. As a further safeguard, members or prospective members can send in their lists on plain paper without any indication as to whom they come from.)

It was decided that the name of the Association should be changed to the Wireless Trades Protection Association, Ltd. (Manufacturers and Wholesalers), and that application for permission to change the name should be made forthwith to the Board of Trade.

It was proposed by Mr. W. F. Harkness (Portable Utilities Co., Ltd.), and seconded by Mr. C. F. Halsall (Radio Reception Co.), that a Committee be appointed to work in conjunction with the Association, and the following gentlemen have consented to act *pro tem.*:—Messrs. J. Cruwys (Power Equipment Co., Ltd.); W. J. McLeod (McLeod & McLeod); G. W. Goodchild (Goodchild & Partners, Ltd.); A. E. Watkins (Watmel Wireless Co., Ltd.); A. E. Frost (A.E.F. Manufacturing Co., Ltd.); A. W. Knight (A. W. Knight, Ltd.); W. F. Harkness (Portable Utilities Co., Ltd.); C. F. Halsall (Radio Reception Co.); H. Belbin (Belbin & Bowden, Ltd.); A. Preen (Formo Co.); and C. F. C. Neale (Seagull, Ltd.).

Forthcoming Events.

Institution of Electrical Engineers (North-Midland Centre).—Saturday, June 20th. Visit to the hydro-electric power station at Linton Lock, near York.

Institution of Heating and Ventilating Engineers.—June 22nd to 24th. Summer meeting at Birmingham.

Physical Society of London.—Friday, June 26th. At the Imperial College of Science, South Kensington, S.W. Ordinary scientific meeting.

Notes.

"Underground" War Memorial Unveiled.—A memorial service for those members of the Underground Railways, and the associated companies who fell in the Great War was held on June 10th at St. Margaret's, Westminster. A large congregation was present, comprising 150 ex-service men, 500 widows, and many relatives of the departed. Lord Ashfield and the directors and officers of the various companies attended the service, which was conducted by Canon Carnegie, rector of St. Margaret's. In his address the Canon referred to the splendid war record of the companies concerned. Nearly 17,000 of their men enlisted for service, nearly 1,500 being killed, and 283 decorations were gained by them. The service concluded with Chopin's "Marche Funèbre" and the National Anthem.

The memorial which has been erected in the hall of the Underground head offices, 55, Broadway, Westminster, was unveiled by Field-Marshal Sir Wm. R. Robertson, the ceremony being followed by a dedicatory prayer and address by the Bishop of London. The "Last Post" was sounded and wreaths were deposited by Lord Ashfield, Mr. H. A. Vernet, the deputy-chairman (on behalf of the directors), and by Mr. J. C. Mitchell, secretary and treasurer (on behalf of the officers).

Washing Machines in the United States.—The American Washing Machine Manufacturers' Association reports that during the first quarter of the current year its members sold 197,764 washing machines, of which 160,353 were electrically operated. In the equivalent quarter of 1924 the total number of machines sold was 179,461, and of these 148,847 were electrical.

Ayrshire Electricity Board.—At the recent annual meeting of the Ayrshire Electricity Board, ex-Provost Mathew Smith, Kilmarnock, was re-elected chairman of the Board, while Police Judge James Smith, Ayr, and ex-Bailie David Jones, Kilmarnock, were re-appointed conveners of the Finance and Engineering Committees respectively.

Northern Lights.—Prof. J. C. McLennan, of Toronto, who is attending the conference of the International Astronomical Union in London and Cambridge, is reported to have said: "I have been investigating the spectrum of the Northern Lights, and have, by means of laboratory experiments, been able to reproduce the spectrum. The result will be to throw light on the constitution of the upper atmosphere at an altitude of 100 miles."

Appointments Vacant.—Electrical engineer (£450) for the Epsom Urban District Council. Assistant power station superintendent (Rs. 500 to Rs. 650 per mensem) for the Madras Electric Supply Corporation, Ltd. Junior divisional distribution assistant (£221), engineering assistant for substations (£248) for the Hull Corporation Electricity Department. Resident electrical engineer (£250) for the Ulverston Urban District Council. Mains superintendent for the Worcester Corporation Electricity Department. (See our advertisement pages to-day.)

Damped-wave Radio Direction Finding.—For the use of ships fitted with radio direction-finders, beacon transmitting stations are being inaugurated in various parts of the world. In order to minimise interference it is evidently desirable that beacons shall work on undamped or modulated undamped waves, and confidence in the accuracy of direction-finding when using these waves must accordingly be inspired in those who will make use of this application of radio signalling for navigation purposes. In a paper he recently read before the Wireless Section of the I.E.E., Mr. R. C. Smith-Rose, Ph.D., M.Sc., A.M.I.E.E., summarises the hitherto published knowledge on the relative advantages of damped and undamped waves for accurate direction-finding, and then describes some special experiments which have been carried out in this country by the N.P.L. for the Radio Research Board on this particular point. It is concluded that when direction-finding is employed at such times and under conditions which are known to produce the well-known "night effects" of variable errors in bearings and broad signal minima, these effects are equally likely on damped and undamped waves. Since the conditions under which direction-finding is accurate enough for marine navigation purposes at all times are now well known to be connected only with the distance of transmission over land and sea, it is to be inferred that the type of transmitted wave is immaterial to the accuracy and that continuous waves, whether modulated or not, may in future be used with perfect confidence in all cases in which the damped waves from spark transmitters have given satisfactory results. These views confirm directly experiments that have been carried out by the United States Lighthouse Service with radio beacons provided with modulated continuous-wave transmitters for the use of direction-finders on board ship. Comparative tests made with them and with the ordinary spark beacon transmitter showed that at various distances up to 132 miles over sea the accuracies were practically identical in each case, both by day and by night. The faith of the authorities in their results is exemplified by the fact that they are already introducing modulated continuous-wave transmitters into their beacon stations.

Artificial Telephone Lines.—In Part I of a paper on "Some Artificial Lines and Networks Associated with the Uniform Telephone Transmission Line," contributed to the June issue of the I.E.E. *Journal* by the research staff of the General Electric Co., Ltd. (work conducted by Mr. A. C. Bartlett), it is shown that the problem of constructing a network the impedance of which shall be equal to the impedance of an infinite uniform telephone line, can be solved exactly by the use of a number of sections of simple artificial lines. The artificial lines described are intended entirely for use in this way, and since their propagation constants are widely different from that of the uniform line, they cannot be used as "artificial transmission lines" to which any terminal apparatus might be added. Some of the artificial lines can be used for attenuation correction. In Part 2 it is shown that related networks can be obtained such that when placed in series or in parallel with the infinite uniform line, the impedance of the combination is a pure resistance.

The W. E. Highfield Shield Competition.—The third annual competition for the W. E. Highfield Shield and five additional prizes, under the auspices of the National Association of Supervising Electricians, took place in London on June 9th, 1925. In the unavoidable absence of the President, the chair was taken by the Past President, Mr. A. H. Dykes M.Inst.C.E., M.I.E.E. The number of papers sent in (12) exceeded that of the previous year. The audience made notes as the reading proceeded and eventually entered on a ballot paper the number of marks they had given to each paper, ten being the maximum number of marks for any paper. The fact that only the secretary was aware of the authors of the papers added zest and curiosity to the competition. The result of the voting was announced as follows by the chairman:—1st, Paper No. 7.—"X-Rays and Industry," by R. W. J. Stark, Edinburgh. 2nd, Paper No. 1.—"Temporary Wiring," by C. W. Bullock, London. 3rd, Paper No. 5.—"Suggestions for future development of the N.A.S.E." by E. North, London. 4th, Paper No. 9.—"Buying—a few disjointed thoughts," by R. W. Whitley, London.

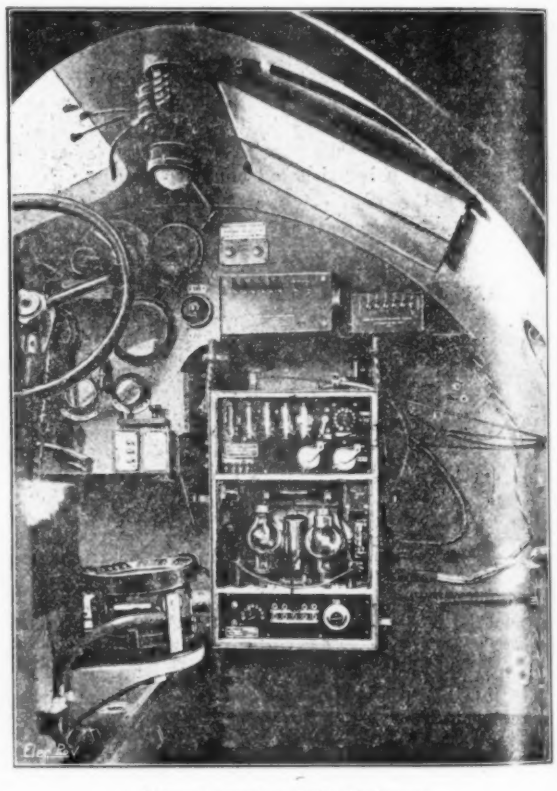
Mr. R. W. J. Stark therefore becomes the winner of the W. E. Highfield Shield and the first prize value £4 4s.; Mr. C. W. Bullock the second prize value £3 3s.; Mr. E. North, the third prize value £2 15s.; and Mr. R. W. Whitley the fourth prize value £2 2s., while Mr. Bullock, being an Associate, also secures the special prize of £1 1s. awarded to the Associate Section.

The donors of the prizes were as follows:—The British Thomson-Houston Co., Ltd.; The Sun Electrical Co., Ltd.; Messrs. Siemens Brothers & Co., Ltd.; the Editor of *Electricity*: Special Associate's Prize, the Board of Control.

Mr. W. E. Highfield, M.I.E.E., the donor of the shield, presented the prizes and congratulated the winners on their success, and expressed the view that the papers were exceedingly good.

Modern Systems of Electrical Installation Work.—In a lecture given by Mr. F. H. Taylor, A.M.I.E.E., A.M.I.M.E., before the Incorporated Clerks of Works Association of Great Britain, on June 8th, on the above subject, the lecturer dealt with the advantages and disadvantages of three modern methods (slip-socket conduit, screwed conduit and metal cased wire) of conductor protection, after a brief survey of the older systems. The questions of earthing and testing for earthing were dealt with at considerable length, the necessity of providing efficient earth connections being stressed; the use of flimsy and badly-designed earthing clips was denounced. The necessity of adhering to the regulations of the Home Office and the Institution of Electrical Engineers was also emphasised.

Aircraft Radio Apparatus.—The accompanying illustration shows a Marconi "all-purpose" 150-watt radio-telegraph and telephone set installed on an Imperial Airway passenger-carrying aeroplane. It is the standard AD6 type of apparatus fitted in British commercial aircraft.



Marconi Aeroplane Radio Equipment.

Electricity in Agriculture.—E.D.A. CONFERENCE.—Arrangements have been made by the British Electrical Development Association for an open conference on "The Use of Electricity in Agriculture" to be held in the Society's official tent at the Royal Agricultural Society's Show, Chester, on Wednesday, July 8, at 10 a.m. It is hoped to secure the Rt. Hon. Lord Bledisloe as chairman. Electrical engineers, farmers and visitors to the show are cordially invited to attend and take part in the discussion, which will be opened by a prominent agriculturist, and by Mr. S. E. Britton (city electrical engineer, Chester), on behalf of the electricity supply industry. The Conference will terminate at 11.45 a.m. prompt on account of the visit of the King at noon. Any further particulars can be obtained from the British Electrical Development Association, 15, Savoy Street, W.C.2.

International Railway Congress.—The registration of members of the 10th International Congress of Railways takes place to-day and to-morrow at the office of the Secretariat General of the Permanent Commission at the premises of the Institution of Civil Engineers, Great George Street, Westminster, S.W.1, where the congress will be held. It will commence on Monday, June 22nd, when the delegates will be received by the Permanent Commission, and the formal opening by the Duke of York will take place at 3.0 p.m. An extensive programme will engage the congress until Tuesday, July 7th. Many excursions have been arranged, including visits to railway works and places of historical and other interests. The mornings will be devoted to the meetings of sections and general meetings.

The celebrations in England of the centenary of the transport of passengers by steam train will be the occasion of a special visit of the Congress to Darlington on July 3rd, when a procession of old and modern railway locomotives and rolling stock will be repeated for the benefit of the members.

In order that the Congress should be held simultaneously with the centenary celebrations in England, it has been advanced two years; in the ordinary way it would have been held in Madrid in 1927. The next congress will be held in Madrid in 1930.

Hydro-Electric Progress in Switzerland.—The following details with regard to hydro-electric progress in Switzerland are taken from a report by the Swiss Water Economics Association. In the first place it is mentioned that the amount of power derived from the water resources of the country, either electrically or directly, during 1923, amounted to approximately 3,063 million kilowatt-hours, which was disposed of as follows:—Lighting power, and heating, 1,682 millions; railway operation, 280 millions; electrochemistry and metallurgy, 580 millions; electric power exported, 521 millions; total, 3,063 millions. The consumption of electrical energy per inhabitant of Switzerland is estimated at 650 kWh per year, a figure which is claimed to be higher than that of any other country.

Dealing with the distribution of the power from an economic point of view, it is stated that at the end of 1923 there were 71 undertakings, which distributed about 90 per cent. of the output of the primary generating stations. The capital of the various undertakings, both privately and publicly owned, amounted to roundly 1,000 million francs. Six companies, with a total capital of 33,900,000 francs, did not give any return to the shareholders, but the average annual dividend declared by the remainder of the private and partly-private undertakings, with an aggregate capital of 300 million francs, was equal to 5.73 per cent.

Among the large new hydro-electricity stations completed during 1924 were the Waggital (first section), Tremorgio, Amsteg (extension), Wynau (first section of No. 2 plant), and Barberine (extension), the additions being equal to about 113,000 h.p., bringing the total capacity of installed hydro-electric plant in the country, excluding the Waggital station, to roundly 1,570,000 h.p.

The principal new plants in course of installation at the commencement of the current year included those at Chancy-Pougny, Waggital (extensions), Klosters, Turtmann, Oberems, Näsel, Champsec, Peussaire (No. 2 plant), Orsieres, and Vernayaz. The total of the new plant in hand amounts to about 407,000 h.p., equal to an annual energy output of 675 million kWh. When completed they will bring Switzerland's hydro-electric productive capacity up to 1,977,000 h.p. and 5,870,000,000 kWh per annum. Even this huge total is, however, estimated to be only about 30 per cent. of the aggregate water power resources of the country.

In addition to the plant just mentioned, a number of new important stations are projected, the construction of which is expected shortly to be taken in hand. Among them are five in the Rhine area, four on the River Aare one in the Liminat district, and two on the Rhône. Taking the Swiss portion only, these additions will represent an increase of over 1 million h.p. and 2,800,000,000 kWh in annual output.

Institution Notes.

Association of Consulting Engineers (Incorporated).—The annual general meeting of the Association was held on May 29th, the chairman Mr. S. R. Lowcock, M.Inst.C.E., presiding. In moving the adoption of the report and accounts, Mr. Lowcock said that a sub-committee had been appointed to bring the rules up to date, and another sub-committee was dealing with practice in connection with ferro-concrete work. The report stated that the membership stood at 107. Although the British Engineering Standards Committee, pressed by the Association Committee, had found itself unable to carry the proposal to adopt the same standard pressures for both direct and alternating systems of supply, and the respective d.c. and a.c. pressures had been fixed at 220 and 240 V, the matter had again come under consideration during the past year, and it had been resolved to adopt the same pressure—230 V—for both systems. A very large amount of valuable work had been done during the year by the Association representatives on the various committees of the B.E.S.A. The Committee had been in communication during the year with the Institution of Civil Engineers on the subject of advertising for consulting work by insurance companies employing on their staffs members of the Institution of Civil Engineers.

The report was adopted, as well as the accounts, which showed a balance of £250. New members of the Committee were elected, namely, Messrs. W. J. E. Binnie, H. W. Couzens, G. M. C. Taylor, and B. G. White (London members); Messrs. H. N. Allott and B. H. Blyth (country members). Votes of thanks were accorded to the chairman and hon. officers.

Institution of Electrical Engineers.—WIRELESS SECTION COMMITTEE.—The following have been elected members of the Wireless Section Committee for the Session 1925-26:—*Chairman*, Major B. Binyon, O.B.E., M.A. *Ordinary Members of Council*, Mr. R. C. Clinker, Mr. P. R. Coursey, B.Sc., Mr. C. F. Elwell, Prof. C. L. Fortescue, Prof. G. W. O. Howe, D.Sc., Captain N. Lea, B.Sc., Mr. C. F. Phillips, Captain H. J. Round, M.C., Mr. E. H. Shaughnessy, O.B.E., Commander J. A. Slee, C.B.E., R.N., Mr. C. F. Trippe, Mr. L. B. Turner, M.A., and Commander G. C. Candy, R.N. (nominated by the Admiralty) Major H. C. B. Wemyss, D.S.O., M.C. (nominated by the War Office), Major H. P. T. Lefroy, D.S.O., M.C. (nominated by the Air Ministry), Major A. G. Lee, M.C. (nominated by the Post Office).

Our Personal Column.

The Editors invite electrical men, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

The Loughborough Town Council has decided to grant the borough electrical engineer the sum of £500 for the carrying out of extensions to the electricity works. The work was begun by the late Mr. Wordingham, who it was said would have received £1,500 to finish the scheme if he had lived. It is being carried through by Mr. Leach, who, it was stated, will pay certain employés extra remuneration out of the sum mentioned.

Mr. D. BAILLIE, superintendent of the Pinkston power station of the Glasgow Corporation Tramways, retired on May 31st and Mr. JOHN WILSON, deputy superintendent at Pinkston, has been promoted to the vacancy.

The Aylesbury Corporation has increased the salary of the electrical engineer (Mr. W. A. TURNBULL) from £560 to £660 and the Treasury scale for the use of his motor-car.

The engagement is announced of Mr. R. H. M. DRAKE, the only surviving son of Mr. Bernard Drake (chairman of Drake and Gorham, Ltd., and other companies) to the only daughter of Sir Wm. Leese, Bart., and Lady Leese. Mr. Drake was educated at Eton and Magdalene College, Oxford, served with the Royal Horse Artillery in Palestine as A.D.C. to General King, and afterwards went through a course in the works of the British Thomson-Houston Co. at Rugby.

Mr. S. NICHOLS, for many years on the staff of the Birmingham office of the British Thomson-Houston Co., Ltd., has been appointed manager of that company's office at Middlesbrough.

The Stretford Urban District Council has appointed Mr. J. A. ROBERTSON, of Manchester, as its representative on the Engineering Advisory Committee of the South-East Lancashire Electricity Advisory Board for the current year.

The May *British Chamber of Commerce Journal* (Shanghai) reported that Messrs. H. G. WRIGHT and V. OLSEN, of the Municipal Electricity Department, had left Shanghai on home leave.

We extend our congratulations to Mr. S. E. FEDDEN, general manager and chief engineer of the Sheffield Corporation Electricity Department, on the completion of 25 years' service in that capacity. On the evening of June 12th, to mark the occasion, he was presented with an illuminated address, a gold cigarette case, and a silver tea and coffee set by the staff and employés, who number 1,000. Speeches were made by Messrs. J. A. Dear, J. W. Barnes, and A. Doxey. The last-named who is described as the veteran of the Department, made the presentation. Mr. Fedden, in replying, referred to the growth of the undertaking, and recited a number of interesting reminiscences. He said that he had worked under nine different chairmen, and that Alderman Styring, his first chairman, was the only original member of the Committee who now held a seat on that body. Mr. Fedden's offer of a challenge cup or bowl to the Sports Committee of the Department was very heartily received.

The Weymouth Electricity Committee has appointed Mr. E. A. BORROWDALE, of Newport (Mon.), as station superintendent at £387 per annum.

The Bournemouth Town Council has increased the salary of Mr. C. H. WOODWARD, borough electrician, from £250 to £275 per annum, rising a year hence to £300.

Mr. M. G. WALLACE, B.Sc., A.M.I.E.E., has resigned his appointment as combustion engineer of the Stirling Boiler Co. to take up the London representation of Howden-Ljungström Preheaters (Land), Ltd. His address will be Caxton House, Westminster.

Mr. T. P. PASK, M.I.E.E., has been appointed Chief Electrical engineer of the South African Railways and Harbours Department. Mr. Pask received his early training as an electrical engineer with Baily & Grundy, Ltd., of Cambridge, and

he went to South Africa in 1894. For the past two years he has been acting chief electrical engineer during the absence overseas of the senior officer, Mr. F. W. Mills, M.I.E.E., who is now retiring.

Mr. S. G. HALL, technical assistant in the Melbourne Electricity Supply Department, is paying a twelve-months' visit to this country to gain experience of British power-station practice.

Obituary.—MR. H. B. MARSHALL.—We regret to learn that Mr. Harry B. Marshall and Mrs. Marshall recently met with an untimely death in a motor accident at a grade crossing, near Owosso, Michigan. Mr. H. B. Marshall was the president of the Marshall Electric Company, St. Louis, U.S.A., and prior to the formation of his company for the development of the Marshall system of constant potential charging, he was for 17 years connected with the Electric Storage Battery Company of America, as executive manager of the St. Louis branch office. He was one of the early pioneers of the constant potential battery charging system.

MR. E. R. MYERS.—The death of Mr. Ernest Robertson Myers, overhead line superintendent of the Liverpool Corporation tramways, occurred recently. Mr. Myers was for several years associated with the British Westinghouse Company and subsequently with Messrs. Balfour, Beatty & Co. He was an associate member of the Institution of Electrical Engineers, and a member of the Institute of Automobile Engineers. He was forty-two years of age.

MR. W. MACKENZIE.—*The Times* correspondent at Shanghai reports that on the night of the 15th inst., Mr. William MacKenzie, of the Shanghai Electricity Department, was shot dead by Chinese while motoring just outside the settlement.

MR. R. JORDAN.—The death took place on June 5th, at the age of 74 years, of Mr. Robert Jordan, who had for about 30 years been in charge of the electric light plant on the Milgate Estate of the late Mr. Walter Fremlin, of Bearsted, near Maidstone.

DR. I. C. GAA.—The death is announced from Mannheim, Germany, at the age of 54 years of Dr. Ing. Carl Gaa, one of the directors of the Brown-Boveri Co. of that town. In 1893 when he was only 22 years of age, the deceased was entrusted with the building of the municipal electric light station in Frankfort-am-Main.

Will.—The late Mr. WILLIAM WALTER BRADFIELD, of the Marconi Company, left £3,576.

New Companies Registered.

A. & M. Hamilton, Ltd. (206,474).—Private company. Registered June 6th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers of and dealers in radio apparatus, motor cars, &c. The subscribers (each with one share) are:—S. V. Miden, 36, Stanhope Gardens, Highgate, N.6, merchant; Kathleen McCahey, 3, Macome Road, Plumstead, clerk. The first directors are to be appointed by the subscribers. Qualification, 5 shares. Solicitors: De Meza and Mcmasse, Bank Chambers, 24, Bishopsgate, E.C.2.

C. Jackson & Co., Ltd. (206,483).—Private company. Registered June 6th. Capital, £240 in £1 shares. Objects: To carry on the business of general electrical contractors, dealers in electrical accessories &c. The directors are:—C. Jackson, 8, Randolph Gardens, N.W.6, electrician; A. Levy, 20, Blenheim Terrace, N.W.8, electrician. Remuneration as fixed by the company. Registered office: 61c, Abbey Road, St. John's Wood, N.W.8.

Central Electric and Radio Co., Ltd. (206,407).—Private company. Registered June 4th. Capital, £500 in £1 shares. Objects: To acquire the business of radio apparatus dealers and electricians, formerly carried on by J. H. O'Connor and D. Wales-Smith, at the Picturedrome Buildings, Eastbourne. The subscribers (each with one share) are:—R. Wales-Smith, "Caya," King's Avenue, Eastbourne; W. J. Dawson 5, Birling Street, Eastbourne, managing clerk. The first directors are not named. Secretary: Freda V. Hills. Solicitor: C. W. Mayo, Ia, Terminus Buildings, Eastbourne.

Super Wireless, Ltd. (206,459).—Private company. Registered June 5th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in all kinds of electrical and other instruments and appliances in connection with radio telegraphy, &c. The permanent directors are:—H. W. Taylor, Stavros, Wash Lane, Timperley; B. Atkinson, The Cottage, Catherine Road, Bowden; J. W. V. Smith, Sunnyside, Middleton. Qualification, 200 shares. Solicitors: G. Cates, 17, St. Ann's Square, Manchester. Registered office: 31, Brazennose Street, Manchester.

Television, Ltd. (206,588).—Registered as a "private" company on June 11th, with a nominal capital of £3,000 in 2,900 ordinary shares of £1 each and 2,000 founders' shares of 1s. Objects: To acquire all or any of the rights in inventions relating to "a system of transmitting views, portraits and scenes by telegraphy or wireless telegraphy" comprised in and covered by registered patents No. 222,634 and 230,576, and provisional specification Nos. 4,810, 6,363, and 6,774, of 1924, and Nos. 48 and 911, of 1925, &c. The first directors are:—J. L. Baird, The Lodge, Argyle Street, Helensburgh, N.B., electrical engineer; W. E. L. Day, "Hollydene," 15, Cholmley Park, Highgate, N.6, merchant. Qualification, 250 shares of either class. Remuneration as fixed by the company. Secretary: J. L. Baird.

W. R. Harding & Co., Ltd. (206,569).—Private company. Registered June 10th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, manufacturers of and dealers in wireless and radio apparatus of all kinds, mechanical, electrical and radio engineers, advertising contractors and agents, &c. The first directors are:—W. R. Harding, 50, Westbury Road, Walthamstow; G. J. Pooley, 25, Kenilworth Avenue, Walthamstow (both permanent, subject to each holding 10 shares). Solicitor: P. W. Purdy, 172, Bishopsgate, E.C.2. Registered office: 172, Bishopsgate, E.C.2.

Radio Advertising, Ltd. (206,506).—Private company. Registered June 8th. Capital, £7,500 in £1 shares (2,500 7 per cent. cumulative preference and 5,000 ordinary). Objects: To carry on the business of general advertising contractors and radio publicity agents, and any other business directly or indirectly connected with the utilisation of broadcasting for advertising purposes, &c. The subscribers (each with one share) are:—J. E. Burt, trading as Burt Bros. & Co., advertising contractors, 8, Drapers Gardens, E.C.2; G. R. Thursfield, director of Investment Securities Co., Ltd., 147, Queen Victoria Street, E.C. The first directors are:—G. R. Thursfield, 90, Oakley Street, Chelsea, S.W.3, electrical engineer; A. H. Curtis, Caramore, Shawser Road, Bedford, electrical engineer; J. T. Mould, Russell House, 20, The Drive, Golders Green, N.W.4, electrical engineer; C. A. Mower, 14, Collingham Gardens, Earl's Court, S.W.5, mechanical engineer. Qualification, £100. Remuneration as fixed by the company. Secretary: W. H. Ward. Solicitors: Mills and Morley, 38, Lincoln's Inn Fields, W.C.2. Registered office: 147, Queen Victoria Street, E.C.4.

Walter Denis Manufacturing Co., Ltd. (206,590). Private company. Registered June 11th. Capital, £500 in £1 shares. Objects: To acquire the business of a manufacturer of and dealer in plating and electrical contacts, magnetos, magneto accessories, radio parts and fittings, &c., carried on by Walter Denis Meagher at 21, Severn Street, Manchester, and at 85, Terminus Chambers, 6, Holborn Viaduct, London, E.C., as the "Walter Denis Manufacturing Co." The subscribers (each with one share) are:—W. D. Meagher, 4, Blair Road, Alexandra Park, Manchester, magneto dealer; Mrs. M. Meagher, 4, Blair Road, Alexandra Park, Manchester. Walter Denis Meagher is sole governing director for life, subject to holding 200 shares. Solicitor: H. E. Kay, 40, King Street, Manchester. Registered office: 21, Severn Street, Manchester.

Official Returns of Electrical Companies.

Buckley, Saunders & Co., Ltd.—Issue on May 28th, 1925, of £600 debentures, part of a series already registered.

J. A. Stevens, Ltd. — Satisfaction in full on May 19th, 1925, of debenture dated November 7th, 1924, securing £4,000.

General Sign Co., Ltd.—Particulars filed of £500 debentures authorised May 22nd, 1925, charged on the company's undertaking and property, including uncalled capital, the amount of the present issue being £300.

Electrical and Chemical Ebonite Co., Ltd.—Debenture dated May 27th, 1925, to secure £5,000, charged on the company's undertaking and property, present and future, including unpaid capital. Holders: Walbrook Trust, Ltd., Bush House, Aldwych, W.C.

Evendrawn Accessories Co., Ltd. — Particulars filed of £250 debentures authorised May 26th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £100.

Jackson, McConnan & Temple, Ltd.—Satisfaction in full on May 28th, 1925, of debentures dated October 1st, 1923, securing £17,000.

F. E. Baker, Ltd.—Two notices of the appointment of C. J. Pain, of 18, Low Pavement, Nottingham, C.A., as receiver and manager on May 25th and 26th, 1925, respectively, under powers contained in first mortgage debentures issued on April 15th, 1910, and May 19th, 1911, and debentures dated June 6th, 1918, and May 19th, June 17th and August 11th, 1920.

International Exaphone Co., Ltd. — Particulars filed of £1,000 debentures authorised April 24th, 1923, charged on the company's undertaking and property, present and future, the amount of the present issue being £650.

Stella Lamp Co., Ltd. — Satisfaction to the extent of £3,000 on April 11th, 1924, of debentures dated June 7th, 1922, securing £25,500 (notice filed June 6th, 1925).

G.W.I., Ltd.—W. B. Pearson, of John Street, Bedford Row, W.C., was appointed receiver and manager on June 2nd, under powers contained in debentures dated April 24th and May 14th, 1925.

Liverpool Electrical Engineering Co. (1923), Ltd.—C. Hodgson, of 41, North John Street, Liverpool, was appointed receiver on May 21st, 1925, under powers contained in debentures dated August 3rd, 1923.

General Radio Co., Ltd.—Issue on November 27th, 1923, of £600 debentures, part of a series already registered. (Notice filed June 4th, 1925.)

Joseph Walton & Son (Nelson), Ltd. — Mortgage on Bradley Machine Works, Calvert Street, Nelson, dated May 25th, 1925, to secure all moneys due or to become due from the company to the Bank of Liverpool & Martins, Ltd.

Edison Accumulators, Ltd.—Debenture dated May 18th, 1925, to secure £18,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Lloyd's Bank City Office Nominees, Ltd., 72, Lombard Street, E.C.

Launceston and District Electric Supply Co., Ltd.—Particulars filed on June 2nd, 1925, of £3,500 debentures and bonus of 4 per cent. authorised June 25th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, subject to amount due on first series of similar debentures, the amount of the present issue being £2,500.

Rees Roturbo Manufacturing Co., Ltd. — Mortgage on freehold engineering works, Wednesfield Road, Wolverhampton, with fixtures, &c., dated May 21st, 1925, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

Northwood Electric Light and Power Co., Ltd.—Particulars filed of £30,000 debentures authorised May 11th, 1925, charged on the company's undertaking and property, including uncalled capital, the whole amount being now issued.

Vickers, Ltd.—Mortgage dated May 14th, 1925 (supplemental to trust deed dated April 1st, 1924, securing an issue of first mortgage debenture stock for £3,250,000 and a premium of 3 per cent. of £2,000,000 thereof) charged on freehold and leasehold hereditaments at Sheffield, Dunston-in-Furness and Erith, and benefit of covenants relating to part thereof. Holders: Glyn, Mills & Co., 67, Lombard Street, E.C.3, bankers, as trustees for the first mortgage debenture stockholders.

Medway's Safety Lift Co., Ltd.—Debenture dated May 27th, 1925, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Thomas Stevens Motors, Ltd., Victoria Works, Maidstone.

City Notes.

United River Plate Telephone Co., Ltd.

The annual meeting was held on June 9th, Mr. Percy Cross presiding. In presenting the report and accounts (ELEC. REV., June 5th, p. 908), Mr. Cross said that, owing to ill-health the chairman of the local committee, Dr. S. G. O'Farrell, had been compelled to resign, and his place had been taken by Dr. Manuel M. de Oca. The business had made satisfactory progress, but the company was suffering from a shortage of spare plant to meet the antici-

patal development. He (the chairman) had explained to Dr. Alvear, the President of the Argentine Republic, that the company would shortly have to take a big step forward by incurring large capital expenditure, some of which would produce very little revenue for a considerable period, and that a small margin of surplus revenue would enable them to undertake the necessary outlay without endangering their fair but by no means enormous dividend. At the end of the war they had found themselves in a very difficult position as regarded the supply of equipment, but since that date over £3,000,000 had been spent on plant, although even now they were unable to supply telephones to all who wanted them. Contrary to the usual rule, in the case of telephones installation costs did not get smaller as the number of subscribers increased, owing to the all-round exchange increase which was necessary. The future telephonic development in Argentina was practically unlimited, and their consulting engineers had accordingly drawn up a scheme covering the next ten years. During that time it was estimated that £8,000,000 would have to be expended in Buenos Aires alone to provide a service worthy of that great city. The system outside Buenos Aires was expected to require an expenditure of between £400,000 and £500,000 yearly, so that the company's investment in plant by the end of 1935 might reach a total of £20,000,000. The programme had already been embarked upon, and it was intended to employ the automatic system, so that by 1935 85 per cent. of the telephones in the city would be linked up to automatic exchanges. During the past year the number of stations on their system had risen by nearly 17,000 to 131,446, of which about 91,000 were in Buenos Aires. The prospects not only in Buenos Aires, but in the larger cities—Rosario, Cordoba, Bahia Blanca, and Santa Fé—were good for telephone development, but rates would have to be maintained on a paying basis. He thought that the authorities realised this and would co-operate with the company. The company's system in Santa Fé was progressing, and recently the company had secured the local system in San Juan, and was now engaged in modernising and extending it. Direct lines had been installed between Buenos Aires and Cordoba (500 miles) and between Buenos Aires and Tres Arroyos (300 miles). The repeater system was being used on these long lines. A new automatic exchange with an initial equipment of 3,000 lines (ultimately 20,000) was on the point of being put into service at Rosario and the switchboard equipment in Buenos Aires had been increased.

Further capital would be required before long, and the shareholders were being asked to sanction the increasing of the nominal capital by £1,000,000 in 200,000 £5 shares.

The report and accounts were adopted, and a resolution was passed approving the capital increase.

Eastern Telegraph Co., Ltd.

The annual meeting was held on June 9th. Sir John Denison-Pender, G.B.E., K.C.M.G. (chairman) presided, and in presenting the report (*vide* ELEC. REV. June 5th, p. 908), said that there was a total increase in the available net balance of roughly £134,000. The substantial reduction of £158,000 in working expenses was reflected in practically every item in the revenue account, but it was mainly made up of three items, *viz.*: Expenses attending maintenance of cables, due to a reduction in the number of the company's ships; the further withdrawal of war allowances temporarily granted; and the reduction in respect of income tax. These items alone accounted for about £115,000 of the reduction. At the last meeting, the chairman continued, he referred to the fact that committees had been set up at all the company's stations with a view to submitting suggestions for economy and increased efficiency. Many suggestions were submitted but only a very small part of the economies adopted were reflected in the accounts. One of the largest was the increase in the hours of duty in non-tropical climates and the reduction in the overtime rates suggested by the staff itself. The adoption of this suggestion alone should effect considerable reduction in expenses, which he hoped would be reflected in the next accounts, together with other economies suggested by the committees. They had instituted a scheme by which members of the staff were encouraged to submit inventions or suggestions for consideration. Under this arrangement a large number of matters had been submitted; the scheme had been taken up so enthusiastically that the number of ideas put forward had far exceeded their anticipations. An agreement had recently been arrived at with the Commercial and Western Union Telegraph Companies which had enabled them again to carry traffic between Australia, New Zealand, and the United States of America, *via* Europe. Since the laying of the Government-owned Pacific cable in 1902, the whole of this traffic had passed by that route. The number of daily letter telegrams at quarter rates had increased, so far without material detriment to the other classes of traffic. It was not anticipated that any substantial increase in traffic would take place as a result of the reduction in the rate between this country and Australia and New Zealand, which took place on December 1st last. The company's concession in Greece was held to have expired in February 1924, and negotiations were still in progress with that Government for a renewal of the working arrangements. The company had offered, in addition to the facilities afforded by its cables, to erect the most up-to-date radio installation close to Athens for direct working with all parts of Europe. It was hoped that this concession would be speedily ratified. The position in Turkey remained the same, i.e., the company's offices and cables in that country were still closed through the arbitrary action of the Turkish Government. The arrangement with their subsidiaries, mentioned in the report, had been in operation for five months and was working very satisfactorily. Until a definite revival of trade took place, they could not look for increased traffics. Their companies to-day were more highly efficient than at any period in their history. By the development of the "loaded" type of cable the carrying capacity and speed of cables had been greatly increased, so that it had again become necessary to start on a fresh race between the speed of instruments and the capacity of cables. So vast were the possibilities which might accrue through this new form of "loaded" cable that one hesitated to prophesy as to the transmitting capacity that might be arrived at in the future. The company had under consideration the question of duplicating certain cables, and this would be carried out with the new form of cable construction. The fact that many important cable extensions had been decided upon by America, Germany, Italy, England, and the Colonies demonstrated that submarine cables were not only holding their own, but were steadily increasing in all directions.

Anglo-Argentine Tramways Co., Ltd.

This company's report for the past year was dealt with in our issue of June 5th (p. 907). The annual meeting was held on June 9th under the chairmanship of Mr. W. Morris, who presided in the absence through ill-health of Sir G. A. Touche. Mr. Morris read a statement prepared by the absent chairman dealing with the position and outlook of the company. This statement pointed out that the total receipts of £1,059,800 were a meagre return on a capital of over £20,000,000. Of late years the company's efforts had been directed towards a solution of two problems: the relief of the traffic situation in Buenos Aires and the improvement of the position of its employés. The only solution to the first problem was underground construction, but this could not be undertaken unless an adequate return on the capital could be assured. The company was not at present securing a fair return on the money which had already been spent; the improvement of the lot of its employés required increased revenue. Over eighteen months ago the company had prepared an agreement by which it understook to construct a subway provided an increase in fares was sanctioned. The matter was delayed by the Municipality all that time and finally the Finance Committee of the Municipality recommended a refusal to grant a higher tariff, stating that the obligation to indemnify the company for the burden of the pension contribution should be met by deduction from the municipal tax, that certain further tax remissions should be authorised for three years on the company's allowing certain permanent concessions to employés, that the company should be called upon to say, within ten days, whether it would proceed with the construction of subways, and that failing a satisfactory reply the concessions should be declared lapsed and tenders invited for the construction of the subways. Eventually the Municipal Council declared the company's concessions lapsed, and decided to call for tenders. The company appealed against this and the Intendente (who was appointed by the State) vetoed the Council's decree. Since then a new Council had taken office and the company had had to begin all over again with this body. The labour of the last three years had not been wholly wasted, however, for in that time a close study of the needs of the city had been made and the company's engineers had worked out fresh plans which were attractive owing to the advantages which they would offer to the city. These plans were now being studied by the Executive Commission. With their practical experience of both surface and underground transport they were far better able to deal with the matter than any new-comers. They had hopes that a settlement would soon be reached with the new Council, which was earnestly endeavouring to solve the traffic problem.

The directors propose to make payable on July 1st dividends of 2s. 9d. per share on the 5½ per cent. cumulative preference shares, and 3s. per share on the 6 per cent. cumulative preference shares in respect of the half-year to June 30th.

British Electric Traction Co., Ltd.

The annual meeting was held on June 15th, Mr. J. S. Austen presiding. In proposing the adoption of the report (ELEC. REV., June 12th, p. 948), the chairman said that although they had had a good year in the sense that they had earned more money and were able to pay a larger dividend, it might easily have been better. For instance, two years ago they received £22,000 gross from their holding in the London and Suburban Traction Company. Even last year they received £11,000, but this year they would receive nothing. In addition to that they had lost between £7,000 and £8,000 in their holding in the Stoll Picture Company and those two added together made a very considerable loss. In an old established trustee company there were always a number of deferred securities which constituted a valuable secret or hidden reserve. In that respect they were particularly rich. They held in the form of securities a higher nominal value than their ordinary stock. The largest of those holdings was in the London and Suburban Traction Company, in which they held over £880,000 of capital. A few years ago they bought £20,000 debentures of the South Wales Power Company and also £50,000 nominal share capital for which they paid at the rate of 9d. in the £. During the year they had sold those debentures at a profit which would pay for the cost of the shares more than ten times over, and though the

£50,000 had been written down to £12,500 yet judging from the last report, the directors might if they had felt so disposed even then have paid a dividend, and judging from the same report he should be very much surprised if they did not pay 5 per cent. in respect of the current year. Then, again, they had another holding, about £100,000 nominal, in the Northern Ontario Light & Power Company. The stock came to them in a deal and cost them practically nothing. They had never received any dividend from it, but they had been able to sell it recently for approximately £50,000, which, of course, would come into the balance sheet during the current year. Not only did they possess undisclosed reserves, but they possessed a goodwill, and by goodwill he meant the earning power of the company over and above that implied by the possession of certain assets. They had practically sold their Middleton undertaking and though they would not get back what it cost yet they estimated that the re-investment of the money would prove more remunerative than at present. The prospects were bright upon the whole. Mr. E. Garcke seconded the motion and it was carried.

United Electric Tramways of Montevideo, Ltd.

The report for the past financial year shows that the gross receipts amounted to £661,662, an increase of £30,587. The working expenses increased by £28,532. Owing to the improvement in the rate of exchange the loss on this account was only £9,960, as compared with £30,958 in the preceding year. After providing for administration expenses and debenture interest, the profit and loss account shows a credit balance of £72,218. To this is added £4,356 brought forward, making £76,574, which is allocated as follows:—Redemption of debenture stock, £7,251; redemption of ordinary and preference share capital, £2,500; renewals and contingencies, £24,723; preference dividends, £23,250; ordinary dividend (3 per cent.) £11,625; carried forward, £7,222. The number of passengers carried increased by 3,715,490 to 80,074,936, and the car-mileage by 1,169,109 to 11,209,038. Twenty new motor tramcars have been ordered, and ten trailers are under construction in the company's shops. A 3,750-kW turbo-alternator is being installed and h.p. feeders are being laid to two new sub-stations which will be equipped with converting machinery. To meet the cost of these extensions an issue of £450,000 seven per cent. 5-year notes has been authorised. £100,000 of this has been issued; the remainder will be issued on July 1st. The company has not yet received permission to increase its fares to partly offset the burden imposed by the new Social Law. The meeting was held yesterday (Thursday).

Calcutta Tramways Co., Ltd.

Mr. J. G. B. Stone presided at the annual meeting on June 9th, and in moving the adoption of the report and accounts (which were reviewed in our issue of June 5th, p. 909), he said that the bulk of the capital expenditure during the year (£32,997) was in respect of the extension of track, line equipment, the new Karaya depôt, and rotary-converter plant at the Kalighat and Dalhousie Square sub-stations. Many economies had been effected and the result was that although the mileage rose by 9 per cent., the expenses increased by only 2 per cent. The company had already anticipated the public demand for more transport facilities by introducing a fleet of eight omnibuses, and although the financial results were not satisfactory they considered that the 'buses had fulfilled their mission. The company had ordered a further 24 'buses but it was realised that these would only partially deal with the traffic problem of Calcutta, which a Government Committee had under consideration. The company was therefore considering the whole question, pending the publication of the Committee's report, of taking such action in conjunction with the authorities as would adequately meet the transport demands in Calcutta and its suburbs.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The annual meeting was held on June 11th. Sir John Denison-Pender, G.B.E., who presided, in moving the adoption of the report and accounts (*vide* ELECTRICAL REVIEW, June 5th, p. 909), said that the increase of over £77,000 in the receipts was attributable to a slight improvement in Far Eastern and Australian trade conditions in the latter part of 1924, but he was afraid that it would be some time before those conditions really showed any material improvement. The board considered it necessary to duplicate the Perth-Cocos cable, and had placed a provisional order with the Telegraph Construction & Maintenance Co. for manufacturing and laying a cable of the new "loaded" type. There was a slight increase in working expenses, but there was an actual decrease in expenditure of £66,000. This was mainly accounted for by the reduced amount allocated to the maintenance ships' reserve fund. Taxation payable in England was lower by £21,300. The licence to land a duplicate cable between Singapore and Batavia was granted by the Netherlands Indian Government in November last, and the cable was immediately laid and opened for traffic on January 20th. The new repairing steamer *The Cable* was taken over from the builders in October, 1924. She arrived at Singapore on December 1st. Their new offices at Singapore had been completed at a net cost of £91,108. The change over from the old office was effected without any dislocation of communication or delay to traffic. Improved office accommodation had been provided at Sydney, and the reconstruction of premises purchased at Melbourne would be undertaken at no distant date. Negotiations conducted throughout the past year with the Chinese Telegraph Administration by the Great Northern Telegraph Co. and themselves had not come to any satisfactory conclusion. There was, however, some prospect of an agreement being reached before long. The financial conditions ruling in China showed no signs of improvement but as it was expected that the Treaty between the Powers relating to the Chinese Customs Tariff would shortly be ratified, there was a hope that China's finances would be placed on a satisfactory basis.

Electric Construction Co., Ltd.

The annual general meeting was held on June 9th, Mr. P. E. Beacheroft presiding. In moving the adoption of the report, the chairman said that during the whole of the financial year just ended keen competition prevailed, and many orders had to be taken with a very small margin of profit. The results were very gratifying as the gross profit from manufacturing and contracting, and sundry receipts increased by £3,360. That had been accomplished by the constant and painstaking efforts of their technical and commercial staff, by improvements in design, by the use of labour-saving appliances of every kind, and by efficient organisation. Nor could he omit the efforts of the workpeople, for, although the works had not been employed to anything like their full capacity, the output showed a gratifying increase on each of the previous three years. The gross profit on manufacturing and contracting and sundry receipts amounted to £98,795; interest and dividends and transfer fees provided £14,515, as compared with £16,457 last year, a reduction of £1,942. The total at the credit of profit and loss account was £112,910, as compared with £111,493, being an increase of £1,417. The total of the debit side of the profit and loss account was £69,879, as compared with £71,106, a reduction of £1,227. Consequently the balance of net profit was £43,031, compared with £40,386 for 1924, an increase of £2,645. Including the sum brought forward, there was available for distribution £64,748. (The distribution of this was shown in our issue of June 5th, p. 908.) As to the outlook, with the continued foreign competition and high taxation, he could not personally share the confidence that the trade of the country had turned the corner. The demand for certain classes of electrical machinery showed some contraction during the past year, but he was inclined to think that that was only temporary, and that the numerous schemes now under consideration promised a bright future for the industry.

Rangoon Electric Tramway and Supply Co., Ltd.

The annual meeting of this company, whose report was reviewed in our issues of May 1st and 8th, was held in Rangoon on May 1st. Mr. W. Q. Rowett (chairman), who presided, referred to the issue of 50,000 ordinary shares of £1 each during 1924, which, he said, had been subscribed and paid for in full. At the end of the year the amount of debenture stock outstanding was £113,258 of 4½ per cent. and £300,000 of 5 per cent. There was an increase of £16,411 in the trading profits. During the year under review the company received from the Governor-in-Council a new licence to replace its existing licences; this authorised the supply of electricity to an extended area. The original tramway order had also been superseded by a new licence authorising an extension to the Kyaikasan Racecourse. Those new concessions were for a period of 50 years. Both the 3,000-kW turbo-generators had been completed and were in service, and the new pumping plant for the supply of condensing water was completed and under test. The new switchgear was also in satisfactory operation and further gear was being added. The work of changing over to the higher feeder pressure of 6,600 V was making good progress. The supply had now reached the new military cantonments at Mingaladon, the Government brickfields at Kokine, and the town of Insein, and it was hoped to supply the Kemmendine area during the current year. The racecourse line would shortly be opened for traffic and the new car depôt off Pow Lane had been completed. In conclusion, the chairman said that it would be necessary to install further boiler plant, and probably additional turbine plant would have to be considered by the end of the year.

Oriental Telephone and Electric Co., Ltd.

The directors' report for the past year shows a net revenue of £39,307, to which is added £16,288 brought forward, making £55,605. Interim dividends absorbed £33,417, and it is proposed to allocate the balance (£22,417) as follows:—To final dividend of 3½ per cent., less tax, on the preference shares; to a final dividend of 6 per cent. and a bonus of 2 per cent., free of tax, on the ordinary shares; carried forward £11,889. The new charges based on rates per message in addition to fixed rentals having been sanctioned by the Indian Government, were brought into operation in Calcutta and Madras during the latter half of the year. The total number of lines in service showed a satisfactory increase. The licence of the China and Japan Telephone and Electric Co., Ltd., expires in February, 1930. An agreement has been entered into providing for the sale of the undertaking as from July 1st, 1925 to a company to be registered in Hong Kong under the chairmanship of Sir Paul Chater. This company will have a capital of $5,000,000, and will pay $1,646,335 for the undertaking, $1,400,000 in fully-paid shares. The new company will forthwith proceed to improve and extend the undertaking.

French Companies.

The *Compagnie Electro-Mécanique*, after having written off 3,133,000 fr. for depreciation in 1924, has decided to carry forward the balance of 306,000 fr.

The *Compagnie Radio-France* proposes to pay a dividend at the rate of 25 fr. per share out of net profits of 2,707,000 fr. in 1924, the latter comparing with 679,000 fr. in 1923.

The *Compagnie Générale d'Entreprises Electriques* states that the net profits increased from 841,000 fr. in 1923 to 1,075,000 fr. last year; the dividend for 1924 is 12 per cent.

The *Compagnie Continentale Edison* proposes to increase the rate of dividend from 30 fr. per share in 1923 to 35 fr. for last year, the net profits having advanced from 1,101,000 to 1,357,000 fr.

The *Ateliers de Constructions Electriques du Nord et de l'Est (Jeumont)* reports net profits of 5,996,000 fr. for 1924, as compared with 11,990,000 fr. in the previous year. The rate of dividend is reduced from 25 fr. to 15 fr. per share.

German Companies.

The *Duisburg Cable Works Company* states that all departments were fully occupied in the second half of 1924; the net profits for the year were 513,000 marks and the dividend is at the rate of 6 per cent.

The *Sarony Works, Light and Power Company*, of Dresden, reports a surplus of 716,000 marks for 1924, of which 651,000 marks has been applied to depreciation. The preference shares receive 7 per cent. and a balance of 53,000 marks is carried forward.

The report of the *Felten and Guilleaume (Carlswerk) Company*, of Cologne-Mulheim, states that in weight the turnover in 1924 amounted to about 90 per cent. of that in 1922 and 80 per cent. of that in 1913. After the quietness in the demand for cables and wires in the first half of the year a revival in business took place in telephone and telegraph cables, particularly in the final quarter of the year. Besides large orders from the German Distant Cable Company as well as from other home concerns, considerable contracts were booked for export and the deliveries were active until the end of the year. The net profits of 4,060,000 marks permit of the payment of a dividend at the rate of 6 per cent. for 1924.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd.

In a report on the trading of the past six months the directors state that the various sections of their rubber business continue to show a steady improvement. There is an increased demand for the Black Dot "Silver King" golf ball, while the tennis ball and wireless apparatus sections are also making satisfactory progress. The directors say:—"The tire business generally leaves much to be desired owing to foreign competition, both at home and abroad, and it is difficult to understand why the McKenna duties should not now be applied to tires (as was originally the case) instead of exacting a duty on the chassis and coach work only, and allowing foreign tires to enter our home market free of duty. The cause of this relativity of treatment requires minute analysis in the joint interests of the tire industry, and the question of unemployment." The cable-ship, the *Silvergray*, has been fairly well employed during the last six months in making repairs in cables already laid, and laying a new cable between France and Algeria, which latter work has been successfully accomplished during the last few days. It is too early to frame a forecast of the current year's working, so the directors are unable to recommend the payment of an interim dividend on the ordinary shares, but the half-yearly dividend on the preference shares will be paid on July 1st.

Dubilier Condenser Co. (1925), Ltd.

This company, whose formation was recorded in our last issue, published last week an announcement of its constitution, objects, &c., to comply with the Stock Exchange regulations. This states that the original company, whose business the new company has acquired, sold the following numbers of condensers for broadcasting purposes in the past few years:—1922, 108,134; 1923, 664,562; 1924, 1,710,085; and in the first three months of 1925, 539,214. The company's customers included Government Departments and the largest electrical manufacturing companies. The new company holds the exclusive rights of the Dubilier condenser for all countries, excluding sub-licences in France and Belgium, under which the company draws royalties. The profits of the old company, after meeting all expenses and depreciation, but not taxation, were £13,039 in 1922; £28,041 in 1923; £81,818 in 1924; and £32,241 in the first quarter of the current year. In addition to the Dubilier Condenser Co., the new concern has acquired the business of the Mansbridge Condenser Co., Ltd., whose profits are not taken into account.

Globe Telegraph and Trust Co., Ltd.—The report for the year ended May 31st last shows a net revenue of £336,716, and the addition of £49,578 brought forward makes available £386,294. Interim dividends absorbed £239,713 and £15,000 has been transferred to the reserve for contingencies, leaving £131,581. It is proposed to pay a final dividend of 3s. per share on the preference shares, making 6 per cent., and a dividend of 5s. net per ordinary share, making a total of 10 per cent. net for the year. This leaves £51,222 to be carried forward. Meeting, June 23rd.

Stock Exchange Notices. — Dealings in the following have been specially allowed by the Committee under Rule 159:

Midland Counties Electric Supply Co.—200,000 new ordinary shares of £1 each, issued at 22s. 6d. per share, partly and fully paid, Nos. 1,000,001 to 1,230,000; and 250,000 6 per cent. cumulative preference shares of £1 each, partly and fully paid, Nos. 1,000,001 to 1,250,000.

Application has been made to the Committee to allow the following to be officially quoted:—

International Telephone and Telegraph Corporation.—$20,115,200 capital stock in shares of $100 each.

Isle of Thanet Electric Supply Co.—150,000 ordinary shares of £1 each, fully paid, Nos. 1 to 150,000.

Marconi's Wireless Telegraph Co.—500,000 ordinary shares of £1 each, fully paid, Nos. 3,500,001 to 4,000,000.

Whitehall Electric Investments, Ltd.—The report for the year ended March 31st last shows a gross income of £612,043, and a net income, after meeting expenses, debenture interest, &c., of £324,490. The preference dividend is paid and the balance (£155,740) is devoted to the writing-down of the discount on debenture stock. The income did not fulfil expectations as no dividend was received from the Cia. Electrica de Tampico owing to labour troubles in Mexico. During the current year, however, this company has been operating satisfactorily.

China & Japan Telephone & Electric Co., Ltd. — There was a net profit upon the past year's working of £18,569, and to this is added £10,545 brought forward, making £29,114. The depreciation reserve receives £13,000, and it is proposed to pay a dividend of 20 per cent. tax free, leaving £8,162 to be carried forward. Mention is made in the report of the transfer of the undertaking to the newly-formed Hong Kong Telephone Co. This was referred to in the report of the Oriental Telephone & Electric Co., Ltd., which is reviewed on the preceding page.

Aron Electricity Meter, Ltd.—The net profit for the year ended March 31st last was £12,244 and to this is added £2,256 brought forward making £14,500. As we have already reported, the dividends on the preference shares are to be brought up to date by the payment of 9 per cent. in respect of the 18 months ended March 31st last, and the ordinary shares are to receive 3 per cent. for the year. A balance of £3,124 is carried forward, subject to additional income tax. Meeting, June 23rd.

Kidderminster and District Electric Lighting and Traction Co., Ltd.—A net revenue of £6,192 was earned during the past year, and to this is added £655 brought forward, making £6,847. After meeting expenses and loan interest and providing £1,000 for renewals, it is proposed to pay a dividend of 2½ per cent. on the ordinary shares, to place £500 to reserve, and to carry forward £606.

British Columbia Telephone Co.—After providing for depreciation, the amount available from the past year's working was $667,688. Debenture interest is paid, $80,000 is transferred to fire loss reserve, and $50,000 to pension fund; dividends amounting to 8 per cent. have been paid on the ordinary shares (as in 1923), and a balance of $75,476 is transferred to surplus.

Swedish-Mexico Telephone Co.—The report of the *Mexikanska Telefon A.B. Ericsson* states that business proceeded satisfactorily in 1924, and a new exchange was opened in the suburb of Tacubaya. The net profits amounted to 806,000 kr., as compared with 883,000 kr. in 1923, the dividend being maintained at the rate of 12 per cent.

J. Stone & Co., Ltd. — The balance available from the past year's working (including £138,891 brought forward) is £359,097. After meeting the preference dividend and transferring £125,000 to reserve, a dividend of 10 per cent. is to be paid on the ordinary shares, leaving £135,057 to be carried forward.

Richard Johnson, Clapham & Morris, Ltd.—There was a loss of £7,459 on the past year's trading, but a credit balance of £19,419 brought in enabled the final preference dividend to be paid and a balance of £8,080 is carried forward.

British Thomson-Houston Co., Ltd. — The half yearly dividend on the 7 per cent. cumulative preference shares, less tax, is payable on June 15th.

Quebec Power Co.—Dividends of $1¾ on the preferred shares and $1¼ on the common shares have been declared for the quarter ending June 30th.

Howard & Bullough, Ltd.—A final dividend of 2½ per cent. (making 10 per cent. for the year), is recommended, and £155,129 is to be carried forward.

Manila Electric Corporation.—A dividend of 62½ cents per share has been declared on the common stock for the quarter ending June 30th.

Pinchin, Johnson & Co., Ltd.—The usual preference dividend (at the rate of 6¾ per cent.) has been declared for the half-year to June 30th.

Shawinigan Water and Power Co.—A dividend of $1¾ per common share has been declared for the quarter ending June 30th.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have a new, and unwelcome addition to their factors this week, in the shape of the grave news from China. This created an air of uneasiness in regard to Asiatic politics and the purely investment stocks have drooped like cut flowers in the heat. Rubber shares lost little of their resiliency, though they parted from some of their enthusiasm. In the rubber market, however, public business continues upon a very heavy scale.

The only direct effect of the Chinese news upon electrical issues is seen in ¼ fall, to 2½, in Shanghai Electric Construction shares.

British Electric Traction ordinary stock stands out as the brightest feature of our price-lists. It has risen 5½ points to 118, comparing with 100 at which the price started this present year. The excellent report is the reason, of course, for the buying. No change has been made in the preference, at 110½. London & Suburban Traction 4½ per cent. debenture strengthened to 54½. The Home Railway stocks are dull. A sharp break occurred in Metropolitan Consolidated on fears lest the dividend should not be maintained. The price is 2½ lower at 72.

Anglo-Argentine Tramways preferences are firmer as a result of the chairman's speech at last week's meeting. He declared that a utility company should be free, and encouraged to give good public service, unburdened by handicaps thrown in the way of its financing and other activities. The second preference have rallied to £3. Montevideo Tramways advanced a trifle, to £2, upon resumption of dividends on the ordinary shares, 3 per cent. being declared. Nothing has been distributed since 4 per cent. in June, 1921. The shares are of £5 nominal value, and are fully-paid. The 6 per cent. preference, of the same denomination, are quoted at 4½. Mexico Tramways 5 per cent. bonds lost 2, going back to 63½. Mexican Light & Power common shares are also 2 points lower at 25, but, on the other hand, Brazil Tractions are equally higher. Brazilian generally have taken on a harder aspect. It is cautiously suggested that Brazil has seen the worst of her troubles and that, from now onwards, a steady return will be made towards normal conditions.

The unsatisfactory state of affairs in Mexico is reflected in the report of the Whitehall Electric Investments. The company's interest in the Tampico and Vera Cruz electric undertakings has brought in no dividend in respect of the last year. The gross income, which had been estimated as likely to reach £670,000, came to £612,000, which still showed an improvement over the 1923 figures, and the 7½ per cent. preferences are better at 20s., their par price.

Eastern cable companies' stocks continue listless and dull. Globes are down ½; so are Westerns. Since the introduction of the Budget, with its sixpence in the £1 off the income-tax, less attention has been paid to stocks and shares upon which the dividends are declared free of tax. The four principal Eastern companies are all paying 10 per cent. tax-free dividends. United River Plate Telephones at 6¾ ex dividend show a gain of 1/16 on balance. At the annual meeting held the other day, Mr. P. Cross declared himself satisfied that the field for telephonic development in Argentina is practically without limit, though the war arrested progress. Automatic Telephones hold their gain at 42s. 6d. The wireless group is unaltered. The proposed agreement for setting-up wireless stations in Greece, under the auspices of the Marconi Company, has been rejected by the National Assembly at Athens.

Apart from a rise to 55s. 9d. in County of London ordinary, the list of London electricity supply shares has no variation this week. Metropolitan Electric 7½ per cent. debenture stock advanced to 107½. The manufacturing shares keep very steady. Edisons are better at 8s. General Electrics rose to 26s. 3d. before reacting to 25s. 6d., which latter price leaves the shares 9d. better on the week. Johnson & Phillips are again up to the round 40s. Siemens at 27s. are ex 1s. dividend. Electric Constructions eased off to 32s. 6d. Callenders and Henleys are both ex dividend. The former are also ex rights to the new issue, these being quoted at 10s. 6d. to 12s. A decline of 1/16 to 2 9/16 in Babcock & Wilcox proved rather exceptional to the slightly firmer tendency displayed by the iron, steel and kindred sections. Allusion has been made above to the rubber boom, the work in connection with which is taxing to its uttermost the physical energy of those engaged in its maelstrom.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price June 15 1925.	Rise or fall.	Yield. p.c.
Bournemouth and Poole ...	1	13	14	22	— ⅛	5 1 10
Brompton Ordinary	1	10	10	13	—	*5 14 3
Charing Cross Ordinary	1	14½	15	46/9	—	6 8 9
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	14	—	6 8 0
City of London	1	15	15	48/3	—	6 4 3
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 9
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	15	55/9	+ 9d.	5 7 6
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	—	20/-	—	6 1 9
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation ...		10	10	53/3	—	6 9 4
Kensington Ordinary	5	14	15	12¾	—	5 16 6
Lancs. Light and Power ...	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	35/-	—	5 14
do. do. 6% Pref. ...	5	6	6	5¾	—	5 6 3
Metropolitan	1	10	11	38/3	—	5 15 6
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	24/3	—	4 19 6
Newcastle-on-Tyne Ordinary ...	1	6	7	22/-	—	6 7 3
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	1¼	—	5 6 5
St. James' and Pall Mall ...	5	17½	17½	13½	—	6 7 3
South London	1	15	15	2 7/16	—	6 3 1
South Metropolitan Pref. ...		7	7	1¼	—	5 13 0
Urban Ordinary	1	4	4	15/9	—	5 1 7
do. 6% Pref. ...	1	6	6	20/-	—	6 0 0
Westminster Ordinary	1	15	15	46/6	—	6 9 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	+6d.	7 10 0
Yorkshire Elec.	1	8	8	31/-	—	5 3 3

HOME RAILS.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	4	5	72	—2½	6 19 0
do. District	,,	9½	9½	46½	—	7 4 4
Underground Electric Ordinary	10	Nil	Nil	22	—	Nil
do. do. "A" ...	1/-	Nil	Nil	8/-	—	Nil
do. do. Income	Bonds	6	6	18	—	*6 2

TELEGRAPHS AND TELEPHONES.

		Dividend. 1922.	Dividend. 1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 3
do. Def.	,,	1½	1½	242	—	6 3 1
Automatic Telephone	1	Nil	3	2½	—	2 16 1
Chili Telephone	5	6	6	5 5/16	—	*5 7 10
Cuba Sub. Ord.	10	7	5	6¾	—	7 8 3
Eastern Extension	10	10	10	17½	—	*5 15 1
Eastern Tel. Ord.	Stock	10	10	17 5/8	—	*5 14 9
Globe Tel. and T. Ord.	10	10	10	17½	— ¼	*5 12 11
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	25	33	+1½	6 13 4
Indo-European	25	7	7	41½	—	*4 4
Marconi	1	15	10	1 5/16	—	6 8 0
Marconi Marine	1	10	10	1	—	10 0 0
Oriental Telephone Ord. ...	1	12	12	9 3/8	—	*5 9 7
United R. Plate Tel.	5	8	8	6¾xd	+ 1/16	*5 16 3
Western Telegraph	10	10	10	16¾xd	— ⅛	*6 0 4

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	3⅝	+ ⅛	8 6 0
do. do. 2nd Pref. ...	5	6½	6	3	+ ⅛	10 0 0
do. do. 5% Deb. ...	Stock	5	5	74	—	6 15 2
British Electric Traction Ord. ...	,,	5	6	118	+5½	5 18 8
do. do. 6% Pref. ...	,,	6	6	110½	—	5 8 7
Brazil Traction	100	4	4	57	+2	7 0 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11
do. do. Preferred	,,	5	90/-	86¼xd	—	*5 10 10
do. do. Deferred	,,	8	129/5	106¾xd	—	*6 1 6
do. do. Deb.	,,	4½	4½	77½	—	5 9 8
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	6/-	—6d.	Nil
London United Tram. Deb. ...	Stock	4	4	47½	—	8 8 5
Mexico Trams. 5% Bonds ...	—	Nil	5	63¾	—2	7 17 6
Mexican Light Common ...	100	Nil	Nil	25	—2	Nil
do. Pref.	100	Nil	Nil	61	—	Nil
do. 1st Bonds ...	—	5	5	66½	—	7 10 5
Yorkshire (West Riding) ...	1	—	5	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	20	12	2 5/8	— 1/16*	4 13 7
British Aluminium Ord.	1	5	5	31/3	—	8 1 0
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3¾	—	4 10 3
Brush Ord.	1	10	10	1 7/8	— 1/16	4 11 1
Callenders	1	15	15	8½xd	—	4 5 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord	1	5	Nil	5	—	... ...
Edison-Swan	4/-	7½	10	8/-	+3d.	5 0 0
do. 6% Deb.	Stock	5	5	82½	—	6 1 3
Electric Construction	1	10	10	1½	— 1/16	6 3 1
Enfield Cable, Pref.	1	7½	7½	1½	—	6 2 8
English Electric	1	8	5	18/9	—	6 6 8
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/6xd	—	5 10 8
do. Ord.	1	5	5	25/6	+9d.	3 18 5
Henley	1	15	15	8 1/16xd	—	4 17 10
do. 4½% Pref.	5	4½	4½	4½	—	5 6 6
India-Rubber	1	10	5	1 1/16	—	*4 14 1
Johnson & Phillips	1	5	10	2	+ 1/16	5 0 0
Met-Vickers, Ord....	1	12½	8	23/3	—	6 17 8
do. Pref...	2	8	8	9¾	—	6 14 9
Siemens Ord.	1	5	—	27/-xd	—	*5 11 0
Telegraph Construction	12	20	10	27	—	4 9 0

* Dividends paid free of Income Tax

The Shannon Power Scheme.

By P. T. WHITE, A.M.I.Mech.E.

It cannot be said that the Shannon Development Scheme has received much commendation in the technical or lay Press outside of Ireland. Much of the subject matter of the comments clearly shows that the writers were not informed in general data or particular detail. The Free State Ministry of Industry and Commerce, which is the responsible authority, has, by its extraordinary reticence, very largely contributed to this unfortunate attitude towards the Bill, which has, even in Ireland, met with strenuous opposition. It would be well for the British Press to examine with care the character of that opposition.

On May 29th the Bill passed the Committee stage in the Dail, and the Report stage was fixed for Thursday, May 21st. Mr. McGilligan, the Minister in charge, made an emphatic statement that there was no secret agreement with Messrs. Siemens-Schuckert outside the White Paper, which contained the State's total obligations to that firm. There were no secret pacts. Messrs. Siemens, he stated, would have no power under the scheme after 1929, and no contract was made to give them any right to have anything to do with the purchase or sale of electricity after that date. These are plain statements, and it is a pity they were not made earlier. Had this been done there would have been no opportunity afforded to far from disinterested parties for working up an atmosphere of suspicion and alarming rumour about the undertaking itself and its reaction on existing industries.

When it was pointed out that under the section power was given to the Minister to sell to Messrs. Siemens large "quantities" of electricity at a cheap rate, Mr. Gilligan replied that there had been built on that rumours that the Germans were obtaining a stranglehold on Irish industries, whereas the clause was intended to cover the erection on the Shannon of a small power station for the supply of electricity for the contractors' work on the contract itself and the lighting of workmen's buildings and canteens during the three years' period of construction. Why was not all this set out clearly before, instead of having, as it were, to be dragged from the Minister? It is not surprising in the circumstances that an amendment was moved that the Minister for Finance be not given power to delegate a general authority to the Minister for Industry and Commerce to make contracts for the sale of electricity. The Ministry of Finance would have to pay interest to the amount of £250,000 a year, and the supporters of the amendment did not see why they should sign away their control.

The compensation claims for lands, &c., will probably amount to a large figure, but in the opinion of experts the much-discussed damage to fisheries may not prove such a formidable item. The experts of the Ministry of Fisheries would doubtless provide means to allow fish to ascend to the higher waters.

From the engineering standpoint criticism is directed to many so-called defects in the approved scheme. The concentration of the power in one main station, as proposed by Messrs. Siemens, appears to many engineers who have studied the problem on the spot as decidedly open to objection. This single power station on the lower reaches of the river at Limerick will prove very expensive in the provision of high and long embankments, also arterial drainage will have to be met by power pumping. It is questionable if the Siemens's argument of single power concentration at that particular point will stand the test of experience. The examples quoted by them of successful single power operation are not very apposite, and in the writer's opinion the slow flowing Shannon cannot justifiably be compared with what are neither more nor less than torrents in the Bavarian Alps. The potentialities of the Shannon are at its source and at its outlet to the sea, which in this case would mean a point above tidal waters near Limerick, and between these two points there are over one hundred miles of river winding its course through various lakes which easily transform themselves into natural storage reservoirs, having splendid feeders in their catchment areas. It would appear from a power point of view that the two-station power plan would be the better way, even if the question of distribution of energy were left out. As it is, the natural resources of the Shannon are not utilised to more than sixty per cent. If it is desired at a later period to erect a power plant at the upper reaches there will be a mighty problem for the engineers to solve. One expert stated that it was like a man putting on his tie before looking for his dress shirt.

From the distribution point of view, do the originators really understand the value of the central part of western Ireland as a supply area? The costly trunk lines will have to run hundreds of miles to supply a few places of more than six thousand inhabitants—the rest is barren area. If a second power station were used at the source, the necessity to do this would not arise. It does not appear that this question of scientific distribution has received the amount of careful consideration that its importance demands. If the promoting contractors are regarding the boglands and mountains of Connaught as a splendid field for their energies, they are likely to be disappointed in more ways than one. One gallon of paraffin per month is looked upon by the farmer in these districts as a woeful extravagance in the lighting of his house, but it is when we come to induce him to use power on his farm that we are up against it, and whatever academic notions Messrs. Siemens may have on the question, Mr. McGilligan has none whatever. He knows his man.

The writer is speaking from actual contact knowledge when he states that this proposition of teaching the western peasant modern power usage applied to agricultural purposes is a fearful one, and that the responsible Minister who is prepared to undertake it, knowing its difficulties, as he unquestionably does, is something of a hero. There is no doubt about it—Mr. McGilligan is a strong man, He has carried this scheme through in the face of an opposition which would dismay and confound many statesmen of the highest reputation. He is a dour and determined fighter; he is an organiser of particular merit and he has vision, but can he hope to succeed in this?

Here is an instance which will serve as an illustration: In a moment of weakness, a farmer was persuaded to buy a cream separator to work by hand power. After a few weeks he brought it back to the Limerick agents and said it was "no good at all, at all." "Why?" asked the separator agent. "Whirra, man, the divil himself couldn't thwist it." "Perhaps," ventured the agent, "you haven't been using a really good oil?" "Ile!" roared the farmer; "did ye say ile? Arrah, man, 'tis astray in the head ye are. The divil a drop then I've iver used on any masheen, good, bad, or indifferent. Man alive, shure ile costs money."

The scheme assumes that 16.3 million units will be used in the rural districts. In the opinion of the writer this will not be realised. Taking an estimated load factor of 36 per cent., the available energy is divided on the basis that there will be a consumption per head of 115 units in the cities, 55 units in towns over 5,000 population, and 30 units in smaller towns of 500. There is little doubt that in the case of the cities the estimate will be in order, but towns of 7,000 population are of more importance in Ireland than the allocation of 55 units per head suggests. These towns are the centres of wide and prosperous districts, and their inhabitants are progressive and alert. At present the

small village of a few shops and one-storeyed cottages is hopeless.

Before closing these notes on the great undertaking, I would like to emphasise the fact that in the development of the Shannon, the Government is placing in the service of the people a natural power resource of immense possibilities, but it must be admitted that the fullest and most immediate results will not follow unless steps are taken to prepare, educate, and train the people, and especially the young people, so that they will be in a position to take the fullest advantage of the opportunities which will be placed within their reach; and if this is not done with vision and thoroughness, the results will fall far short of possible realisation. The Ministry is well aware of this. At the present moment a scheme for the training of apprentices and workmen is being considered. Under it, all engaged on production work will be registered and graded according to qualifications, and production work itself will be organised. New industries will be created, and there will be work and opportunities for all willing to take advantage of them. This is very much wanted in Ireland. Although the population of the country is only a little over four and half millions, there are few openings for the industrial worker, and nearly every lad on leaving school tries to get into an office or behind a counter whilst the best material emigrates. This great constructive policy of the development of natural resources will alter all that. It is a clear call to the people to come together and work out their material salvation, and as such it should be welcomed and encouraged by all within the Empire.

The Incorporated Municipal Electrical Association.

Annual Convention at Brighton.

On Monday, June 15th, the thirtieth annual Convention of the Incorporated Municipal Electrical Association commenced with a reception at the Royal Pavilion, Brighton, by the president, Mr. W. C. P. Tapper, and the Mayor of Stepney, Councillor J. D. Sumper, J.P., who were supported by the chairman and vice-chairman of the Stepney Electricity Committee, Councillors J. W. Rosenthal and W. Hasted. Some 544 were present in the Pavilion, an ideal building for the purpose, which was brilliantly illuminated inside and specially flood lighted outside. The illumination was arranged by E.L.M.A., and light of various colours was employed. Dancing followed until midnight. Fine weather prevailed, with every prospect of its continuance, and a more auspicious beginning could not have been desired.

The formal proceedings began in the Dome at 10 o'clock on Tuesday morning, with a civic welcome by the Mayor of Brighton, Ald. C. J. Teasdale, J.P., who expressed his pleasure at the return of the Convention to its birthplace, for the second time, and his good wishes for its success. He recalled Brighton's long association with electricity supply and with the Municipal Electrical Association.

The Mayor of Stepney, in returning thanks for the cordial welcome, explained why the Convention could not be held at Stepney, and expressed the Stepney Council's pride in its borough electrical engineer and its appreciation of his excellent qualities.

Mr. Tapper then delivered his presidential address, of which an abstract is given below, and after a vote of thanks, proposed by Ald. Leese and seconded by Dr. Dewar, had been recorded for the President's splendid work during the past year, a summary of a paper on "Street Lighting," by Mr. Haydn T. Harrison, was read and discussed, whilst the ladies joined Mrs. Tapper in the Drawing Room. An official photograph was taken, and in the afternoon the usual meetings of the committee representatives on the one hand, and of the engineers on the other, took place, and a special meeting for women, to discuss the "Applications of Electricity to Domestic Problems" was held in the Dome. On Tuesday evening the Mayor and Mayoress of Brighton held a reception in the Royal Pavilion, followed by dancing up to midnight.

The programme for Wednesday was to open with the reading and discussion of a paper on "Installation Policy: Its Importance to the Electricity Supply Industry," by Mr. L. L. Robinson, M.Inst.C.E., electrical engineer to the Hackney Borough Council, whilst a visit to Roedean School had been arranged for the ladies. In the afternoon those disposed to indulge in "shop" were to drive by motor coach to the Worthing power station, which is equipped with Diesel oil engines, including one of the latest type of 750-kW output. As an alternative, a motor-coach ride was planned along the coast to Littlehampton and back. A special "I.M.E.A. Evening" at the Regent, Queen's Road, was included in the programme for the day.

Yesterday Councillor W. H. Thickett, of Grimsby, was to read a paper on the question: "Are Municipal Undertakings doing their Utmost to Develop the Demand for Electricity?" and in the afternoon the members were to visit the Southwick power station of the Brighton Corporation, as well as the remote-controlled sub-station at Kemp Town. The evening was reserved for the annual dinner, which was to be held in the Dome at the Royal Pavilion.

To-day's events are the annual general meeting, and in the afternoon a visit by motor-coach to the power station of the Corporation of Eastbourne, where the newest feature is an Allen-G.E.C. turbo-alternator, said to be the largest single-phase set in operation in this country.

This will conclude the formal programme of the Convention; but a number of interesting works are to be open for inspection to-morrow, including the Brighton Corporation tramway car sheds and workshops, Messrs. Allen West & Co.'s electrical factory, the electric railway (opened in 1883), and Mr. R. Borlase Matthews's electrically-equipped farm at Greater Felcourt.

(To be continued.)

Presidential Address.

By W. C. P. TAPPER, Engineer and Manager of the Metropolitan Borough of Stepney Electricity Supply Department (*abstract*).

At our first Convention 114 persons attended. This year the members, delegates and visitors number over 810. In 1897-6 the kWh sold by the municipalities were in the neighbourhood of 30,000,000. The latest published figures give a total sale of 2,982,287,284 kWh. The capital expenditure in 1897-6 was under £4,000,000. Now it stands at £154,418,100. The development in the direction of railway electrification and the domestic demand will eclipse anything seen up to the present.

Looking to the future, the I.M.E.A. will find a large amount of work thrown upon it in connection with the schemes put forward by or at the invitation of the Commissioners.

Here let me pay a tribute to the self-sacrificing devotion with which the Commissioners, with Sir John Snell at their head, have applied themselves to the work of assisting and consolidating the electricity supply industry, and to the measure of success which has attended their efforts.

Perhaps the most complicated and difficult of all tasks and the one with the details of which I am most familiar is the London problem. If the Commissioners' anticipations are fulfilled a Joint Electricity Authority for London will be in existence before the end of the present year.

Throughout the whole country the path of the Commissioners would have been made much easier if more generous provision had been made by Parliament for the compensation of officers and staff who may suffer financially

by the setting up of Joint Electricity Authorities or by other arrangements made under recent legislation. No industry has a right, after having taken the best years of their lives, to allow such men to entertain fears for their future, or to avoid the duty of seeing to it that proper provision is made for their advancing years, when the possibility of obtaining other lucrative employment may, in many cases, be somewhat remote.

Turning now to possible future legislation, there have been whispers that the Government is considering the question of introducing another Electricity Supply Bill. In this connection your Council has used, and will continue to use, every opportunity to impress upon the Electricity Commissioners and the Government the urgent necessity of conferring full hire-purchase, selling and wiring powers upon all municipalities in the country. The extraordinary anomalies that exist in connection with this matter should be cleared up.

Quite a large proportion of municipalities already have these powers, obtained by private or local Acts of Parliament, and in most cases municipal gas undertakings have full selling powers.

The opposition of the contractors to this much needed reform is entirely misconceived. The enormous expansion in installation work which would ensue would bring prosperity to the contracting interests. In most cases the undertakers' operations would be confined to hire and hire-purchase work, which would not compete with the contractor as few, if any, are in a position to finance this class of work. Such powers would, in my opinion, have a far-reaching effect in hastening the introduction of the use of electricity into the homes of our land.

Another matter which I trust will be dealt with by the Electricity Commissioners in any fresh legislation is that of contributions to the relief of rates from the profits of electricity supply undertakings. This should be absolutely prohibited except to the extent to which an undertaking may have made calls upon the rates, when these calls should be refunded with interest.

The acquisition of the undertaking free of cost to the ratepayers and the numerous benefits conferred upon the public in the district both financially and in healthier and more comfortable conditions, as a result of a cheap supply of electricity, provide a more than ample return for the small initial risk run.

In my opinion new legislation should provide that any surplus after paying working expenses, capital charges and the writing-out of capital account of dead assets must be used in :—

The setting up of an adequate reserve fund.

Reduction of charges to consumers.

Transfer to capital account, thus avoiding fresh borrowing to the extent of such transfer. By this means money can be found to finance hire, hire-purchase, and assisted wiring schemes.

Electricity supply should be dealt with upon purely business lines and under no circumstances should it be allowed to become a bone of contention between political parties—local or national.

A very hopeful feature for the future is the setting up by the Electricity Commissioners of an Advisory Committee under Section 4 of the 1919 Act to advise the Commissioners as to :—

(1) What steps are being taken by authorised undertakers to encourage and extend the use of electricity for domestic purposes; the relative effectiveness of such steps; and what further steps could be taken by authorised undertakers in general to bring about an increased consumption of electricity for the purposes in question?

(2) What methods of charge for domestic supplies could be authorised as standard methods (subject to the fixing of an appropriate quantum in individual cases) for adoption at the option of authorised undertakers in lieu of charging by the actual amount of energy supplied or by the electrical quantity contained in the supply?

(3) What legislative powers, if any, beyond those already conferred by the Electricity (Supply) Acts would be necessary to give effect to any recommendations made in respect of questions (1) and (2)?

Your Association has two direct representatives on this Committee, *viz.*, your president and hon. secretary, and indirectly a third member in the person of Mr. S. T. Allen—one of your ex-presidents, who represents the Electrical Development Association.

In conclusion, I trust that the work done at this Convention, when completed, will have added one more page to the record of useful work done by the Association.

Modern Street Lighting.

By HAYDN T. HARRISON, M.I.E.E. (*Abstract.*)

IT is well known that the standard of artificial lighting has been increased by law in many directions, for example in schools, factories, workshops, &c., and by public demand in other directions, such as shops, libraries, reading rooms, churches, and the homes in which we live, and that all this has been done without great expense, due to the more efficient lighting sources which are now available. But in the case of street lighting it will be found that with few notable exceptions the position remains very much the same as it was before the war.

Many attempts have been made by numerous bodies to grade or classify streets or roads in such a manner that the surveyors and municipal authorities may say that this street, being of such and such a class, must be lighted accordingly. The author has been a member of many committees which have endeavoured to deal with the question of classification, but he is of opinion, among other things, that the right people to settle this point are the police authorities.

The writer submits the following schedule for this country :—

	Class of street.	Minimum horizontal illumination.
Grade A.	Residential roads slow traffic only	0.01 ft.-c.
,, B.	Residential districts with by-pass traffic	0.025 to 0.05 ,,
,, C.	Residential districts with intermediate traffic	0.05 to 0.1 ,,
,, D.	Main traffic streets of all classes	0.10 upwards ,,

The author is of opinion that the degree of illumination mentioned in the A, B, C grades should extend to a level with the light sources. In the D grade or any high-class street it should extend to some specified height which will make visible the building frontages and thus improve the appearance of the street.

Glare is a factor which materially affects visibility, but which is very little understood. It is generally defined by the effect, namely, to cause discomfort, annoyance, or interference with vision. A means of avoiding glare is to increase the height of the light source so as to bring it outside the normal fields of vision, but this means is limited by practical considerations (height of post, &c.). The directive system, to a certain extent, obtains the same object by reducing the power of the source at such angles where it would come into the field of vision; this is generally about 60 degrees to the vertical. The power of the light source should then be gradually reduced as the eyes of an observer approach it.

Where sufficient illumination cannot be provided for financial reasons, to produce sufficient visibility by direct light, the contour of objects or obstructions in the road should be accentuated by providing strong contrasts of light and shadow.

A portable photometer is a convenient means of testing street illumination. It is surprising how accurate a small portable instrument can be made, and the similarity which is obtained by different observers. The procedure generally adopted by the author when testing in a road or street is to take a reading at 45 degrees below the lamp, for which purpose the test plate (which is for convenience mounted on a tripod at a suitable height) is turned directly towards the lamp, the distance being measured by a tape measure either from the light source itself or from it vertically below a point, the height of the light source being ascertained when convenient. The test plate and stand is then moved to various distances and measurements taken in the same way, until a point is reached at which the test plate is in line with the ray which reaches the ground half-way between the lights, thus giving the candle power at the point of minimum horizontal illumination. The test plate is then turned round to face the light which is being approached and the operation repeated. Care should be taken to ensure that the light is normal to the test surface, for which purpose a shadow pointer, or lens, is fixed to the test surface on a short projecting arm and the surface adjusted at each reading by arranging that the shadow or light spot is over a mark provided on the test plate. The readings give the direct illumination at various angles, and can be converted to candle power by multiplying by the slant distance squared or the height (above the screen) squared, plus the horizontal distance squared. The minimum horizontal illumination at the road level can be easily calculated from the candle power obtained when the test plate is in line with the ray which reaches half-way between the lights, a simple formula being :—

$$\frac{\text{C.P.} \times \text{H}}{\text{D}^3} \times 2 = \text{horizontal illumination.}$$

In which C.P. = candle power at the angle referred to.
H = height of light source above road.
D = slant distance to point on road half-way between light sources.

If all the luminous energy available were concentrated on the street surface and an even illumination obtained, the lumens per square foot would be equal, a condition which, when considering efficiency, is taken as 100 per cent. The efficiency stated in the various schedules is the ratio of the lumens per square foot at the point of minimum horizontal illumination to the lumens per square foot above mentioned. A very average width is 35 ft., including two side walks each 4 ft. 6 in. wide. The average spacing of light sources at the present time was found to be not less than 150 ft.; therefore we will consider the area $35 \times 150 = 5,250$ sq. ft. As a minimum horizontal illumination equal to 0.01 foot candles was considered the lowest which should be adopted, we will take this as a basis. If this stretch of the road were equally illuminated all over $5,250 \times .01 = 52.5$ lumens would be theoretically sufficient (and as each light would provide half of these, the other half being utilised for the road on the other side) a lamp absorbing 6 watts, rated at 10 lumens per watt, should be sufficient for the purpose. The lamps, if mounted 15 ft. high, would require to give 170 c.p., and therefore if not pro-

vided with suitable reflectors, 2,130 lumens, thus only 2.5 per cent. of the luminous energy provided would be utilised when producing the required minimum degree of illumination. Such a condition is often found to exist in the street lighting even to-day.

The chief reason for the low efficiency will be found in fig. 1, illustrating the road referred to, 150 ft. long, 35 ft. wide, in elevation and plan. The effect of one light source is shown, the area covered by it being divided into six equal sections.

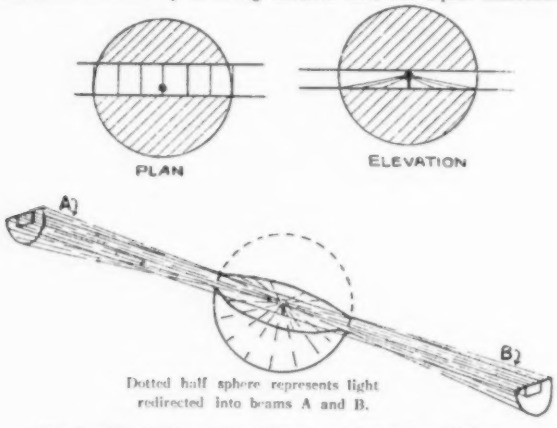


Fig. 1.—Illustration of Low Efficiency of Old Type Reflector.

It will be noted from the elevation that in order to illuminate the two sections near the light source up to a minimum horizontal standard of 0.01 foot candles, 2.25 to 16.5 c.p. is required spread over an angle of approximately 60 degrees from the vertical; the two intermediate sections require 16.5 to 96 c.p. and the two outer sections 96 to 170 c.p. These are round figures, which include illumination derived from the light sources on either side.

In the time of tungsten vacuum lamps, the area of the light source, and the distribution of light from it, did not allow of much improvement being made in the distribution of light without the use of two or more lamps in each fitting.

The holophane type of symmetrical bowl-type refractors now

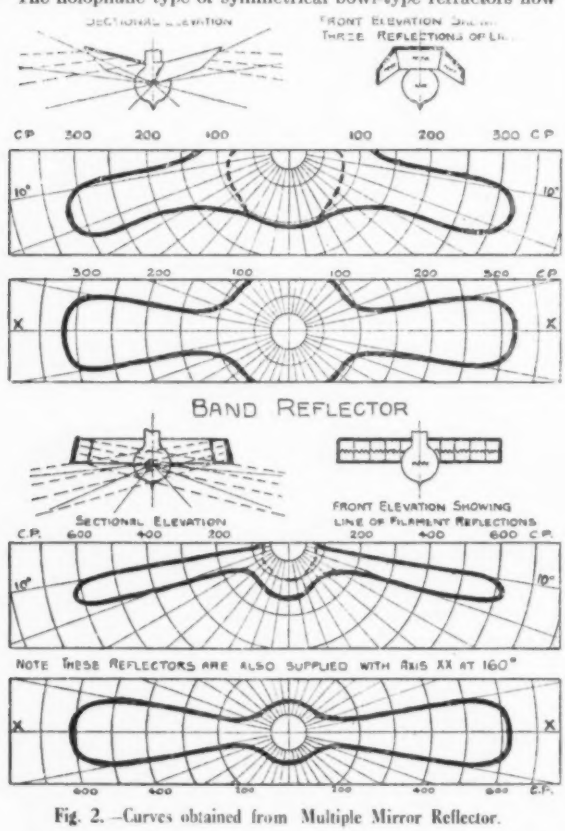

BAND REFLECTOR
SECTIONAL ELEVATION
FRONT ELEVATION SHOWING LINE OF FILAMENT REFLECTIONS
NOTE THESE REFLECTORS ARE ALSO SUPPLIED WITH AXIS XX AT 160°

Fig. 2.—Curves obtained from Multiple Mirror Reflector.

supplied for all-round distribution are claimed to increase the power of light source three times at 75 degrees from the vertical by diverting the light from below and above to that direction, but as the angle over which this increase takes place is very narrow (the c.p. being the same as the source at about 67 to 70 degrees from the vertical), great care is necessary when selecting the mounting height and adjusting the position of the light source. The next development occurred within the last few years and was initiated by the author's longitudinal lighting device, the object of which was to leave the normal distribution of light below the horizontal unchanged, and to concentrate all the upper hemispherical energy within the distant areas of the road or street. On referring to fig. 1, it will be noted that at the point of minimum horizontal illumination, where the c.p. of the source requires to be at its height, the width of the road would be covered by an elliptical or angular section of a cone of 30 degrees. The author therefore decided to concentrate the luminous energy of the upper hemisphere into a cone of light and direct it up and down the street.

This device is probably the most efficient means of distributing light for street illumination purposes. The losses in the reflectors, being of thin glass silvered on the back, are comparatively small. Mathematically it should be possible to increase the c.p. intensity 25 times if the reflectors collected all the upper hemispheral rays. In practice this is impossible, owing to the position of the filament in the lamp bulb and to the fact that it is advisable to allow wide margins of distribution to simplify erection and cleaning. Therefore, these fittings are generally arranged to increase the mean spherical c.p. by about 12 times, as will be seen from curves. These curves are compiled from numerous measurements made in the laboratory and streets, taken by different authorities in various places from the year 1920.

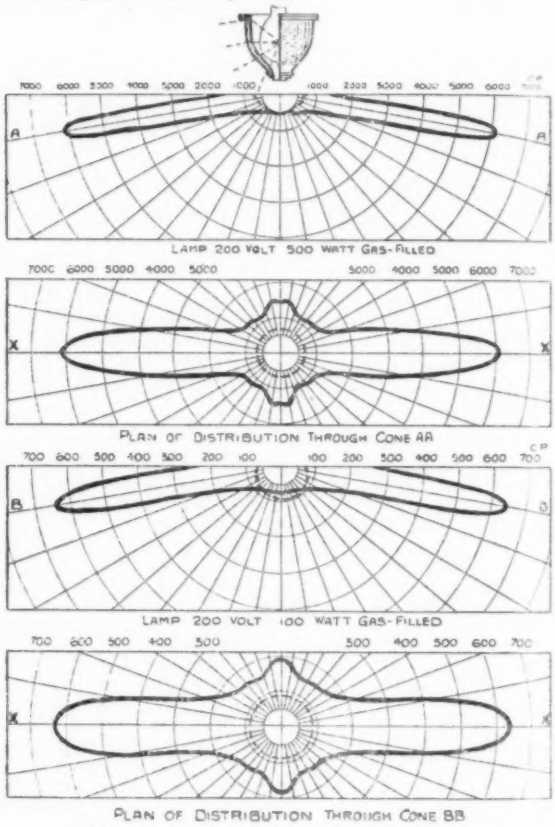

LAMP 200 VOLT 500 WATT GAS-FILLED
PLAN OF DISTRIBUTION THROUGH CONE AA
LAMP 200 VOLT 100 WATT GAS-FILLED
PLAN OF DISTRIBUTION THROUGH CONE BB

Fig. 3.—Curves obtained from Band Type Reflector.

The author decided to produce the appearance of a group of lamps by dispensing with true curves and forming them of plane regular reflecting surfaces fixed at the angles which would multiply the number of reflected images of the light source as nearly as possible in the ratio of the square of the distance of the point to which they were directed and where they were visible. Special apparatus was devised for not only ensuring that the angular setting of the reflecting surfaces was optically correct, but also that the silvered surface was adequately protected against depreciation from climatic conditions or rough handling in the process of cleaning. The success of this device has been greater than ever anticipated, though for obvious reasons it cannot be as efficient from a theoretical standpoint as that already described. These reflectors have now been in use for some time, and numerous complimentary criticisms have been received from many directions. This emphasises the importance of a factor which the author has purposely avoided, namely, the physiological, the most difficult factor with which illuminating engineers have to deal. Numerous cases exist where lighting installations have been designed with the greatest of care and a full knowledge of all the science of illuminating engineering. The results have been everything that has been aimed at, and yet they have not been satisfactory to the majority. This would not be expected to enter into such a prosaic operation as the lighting of streets, but it does so from two points of view, namely, glare and general effect.

These multiple reflecting devices are illustrated diagrammatically in fig. 2. The c.p. resulting is shown in the curves.*

* The multiple Croydon fittings were described in an article published in the ELECTRICAL REVIEW on February 13th, 1925, p. 244.

It will be noted that two distinct arrangements are shown, namely, the Croydon type, where a quantity of luminous flux is still allowed to shine upwards, thus illuminating the buildings on either side, and the band type, in which the upper hemispherical c.p. is reflected downwards, thus enlarging the brightly illuminated area near the lamp, the luminous energy for increasing the distant area being collected from the angles approaching the horizontal angle which are directed inwards and on to the road surface. The effect in the Croydon type lantern is a group of four lamps where one actually exists, increasing the c.p. about 3.5 times. The effect in the band type is a varying number of images and thus multiplication varies from 7 to 12 times, depending on the dimensions of the light source. The increase of c.p. varies from 5 to 8 for the same reason. The latter device is specially useful where existing gas lanterns are being converted to electric light as it can be fitted without disturbing the existing reflectors, which are often very satisfactory for increasing the adjacent illumination. It is also useful as a four-way fitting for cross roads or any position where roads meet, as the direction of the increased illumination can be adjusted on site. A third type deals with cross roads, for which purpose it divides the flux into four at 90 degrees apart. The results obtained by the use of this ingenious device are illustrated by curves in fig. 3 kindly lent by the makers, from which it will be noted that when using 100-W lamps the c.p. for street lighting purposes can be increased 7 times, and with higher power lamps about 12 times. Thus they should increase the efficiency from about 2.5 per cent. to 30 per cent., and in the case of the example shown raising the illumination from 0.01 to 0.065 foot candle.

Time switches would save an expenditure of 15s. per post per annum if scouting could be dispensed with, but scouting is, in the opinion of the author, essential for satisfactory street lighting. He therefore would reckon the saving at about 12s. per annum. A time switch erected and connected costs at the present time about £3 and considering its delicate nature is generally credited with a life of 5 to 10 years, or, say, an interest and sinking fund of 20 per cent., representing 12s. per annum to which must be added the cost of winding, repairs and maintenance.

Hand switching (when all lamps are to be on by lighting up time or extinguished after the scheduled time) represents at least 300 extra lighting hours, or about 7½ per cent. more electrical energy supplied.

The series system, which has been so widely adopted in America, deserves consideration in this country. Take, for example, the large number of small cross streets from one thoroughfare to another. These are generally about the same length and contain the same number of lamp posts. A series wire laid straight in the ground, rising up each post to the lamp terminals, with a cheap magnetic cut-out, without any joint boxes and jointers' costs, would connect the lamps in each cross street to one pole in one of the main streets and the other pole in the parallel main street, only one switch being necessary; the lights of the cross street being the equivalent of a group of lamps from which the revenue is high and the capital low become a sound financial proposition.

Pilot wire control is a method of which the author has had little experience, and one in which it is difficult to obtain or schedule any definite data, as the costs vary with the type and system of mains. When laying new mains, or in the case of overhead mains, the cost of adding a pilot wire should receive consideration.

The "Olipel" distant control gear which was originally devised by Mr. Handcock and Mr. Dykes, in conjunction with the late Mr. Duddell, is now the property of Messrs. Oliver Pell Control, Ltd., and has been perfected and considerable experience of its practical value has been obtained, over a thousand of these relays having been in use for some time in various parts of this country on various systems of supply.

Automatic control by means of the effect of darkness on selenium or similar devices, which at one time appeared to be a possible solution, especially with alternating current, has not been perfected so far as the author is aware, but there are still considerable possibilities in this direction as many such devices were operated during the war and are still being used in other fields for similar purposes.

The author would like to take this opportunity of warning engineers against the use of clear outer globes which are not of the very best quality, as regards glass and freedom from defects. Such globes will very often neutralise the efficiency of a well designed lighting system, for the simple reason that the defective glass may exist in that small area through which all the rays to at least half of the length of the street are directed, thus disturbing the direction and reducing the illumination over a very large proportion of the area to be illuminated.

May the author put forward the plea for standardisation at least in minor accessories? He is the last to wish to impede progress in lighting devices, but in the matter of spigot caps, switches, fuses, extension pieces, time switches or relay cases and numerous other accessories, much money and time would be saved by adopting standard designs.

Spanish Radio Exhibition.—It is proposed to hold an exhibition of radio apparatus in the Ice Palace, Madrid, in November next.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

The "Celestion" Loud-Speaker.

Loud-speakers are now sufficiently numerous in type to occasion some difficulty in choice, but the "Celestion" (fig. 1) ranks high amongst modern instruments of its kind. The

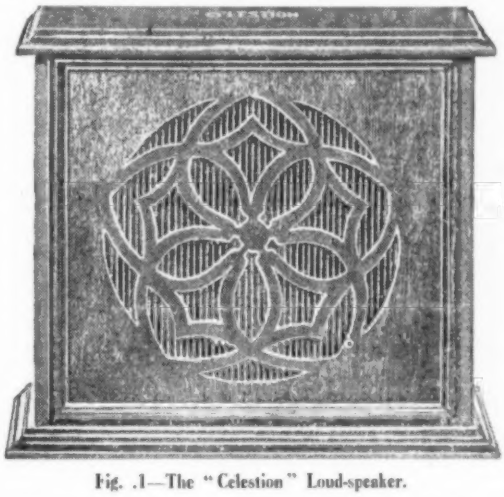


Fig. 1.—The "Celestion" Loud-speaker.

general appearance and tone of the device are pleasing, the quality distinctly good, and our experience of a sample instrument imparted a very favourable impression. Serious atten-

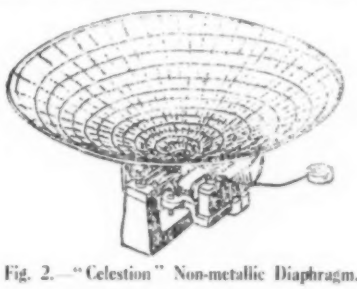


Fig. 2.—"Celestion" Non-metallic Diaphragm.

tion has been paid to its design by the Electrical Manufacturing and Plating Co. and, as fig. 2 shows, this speaker is of the hornless variety, the vibration of the armature, or

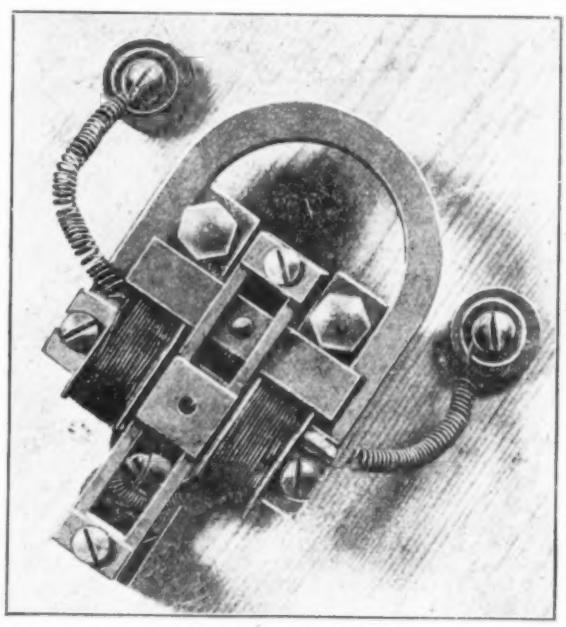


Fig. 3.—"Celestion" Magnet System.

specially shaped reed, being transferred directly to the air through the medium of a large concave "piston" or

diaphragm; the latter is non-metallic and simply screwed to the centre of the reed, quite unrestrained, and its edge is entirely free. The instrument is non-resonant, and both ends of the reed are attached to a bracket which is screwed to the cabinet, while the magnet system (fig. 3) is carried on a single screw and passed through the back of the cabinet so that the distance between the reed and pole face can be adjusted. Very little directional effect is noticeable, but when in use it may be necessary to re-adjust the receiving set; no shunting condenser is required across the loud-speaker, and when a high-frequency by-pass is used its value should not exceed 0.0005 microfarad. Model A1 is made with a resistance of 150 or 3,000 ohms, and the size of the cabinet is 14 in. wide by 13 in. high and 6 in. deep. The instrument is British made and is guaranteed for 12 months provided the seals are not broken.

The "Paramount" Crystal Detector.

Several manufacturers have attempted to obviate the inconvenience sometimes experienced by users of crystal receivers in finding a sufficiently sensitive spot by devising various forms of "permanent" detectors. A device of this nature, illustrated in fig. 4 is marketed by the PARAMOUNT WIRELESS CO., LTD.; no cat's whisker is employed, the two pieces of crystal used being mounted rigidly so that the detector can be handled without fear of damage and, it is claimed, no adjustment

Fig. 4.—"Paramount" Crystal Detector.

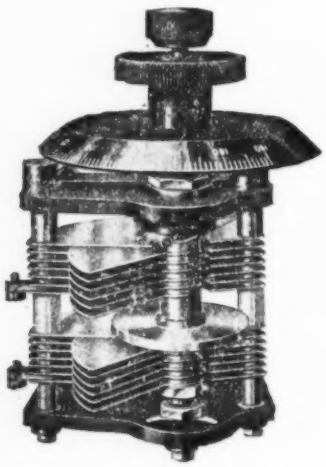


Fig. 5.—New Sterling Square-law Condenser.

whatever is necessary. The device is made dust-proof by the glass bulb, it being mounted after the fashion of a valve and similarly plugged into the set.

A New Square-law Condenser.

Another square-law condenser has recently been placed on the market by the STERLING TELEPHONE & ELECTRIC CO., LTD., in the form of a double condenser, each unit of which is of 0.00025 microfarad capacity. The fixed vanes are entirely insulated from each other, whilst the moving vanes are in electrical contact. Encircling the spindle, and capable of movement up or down between the two sets of fixed vanes, is a small circular balancer plate which (according to its position) slightly alters the capacities of the two condensers. The balancer is controlled by means of a small auxiliary knob, and very fine adjustment is possible. This condenser, fig. 5, will be found very useful in circuits using two or more stages of tuned radio-frequency amplification.

Producing Condensers by the 100,000.

Such is the popularity of the Igranic-Freshman fixed condenser (fig. 6) that no less a quantity than 100,000 is now the minimum stock carried by the Igranic Electric Co., Ltd., to meet the extraordinary demand of the public for this efficient component. Structurally they are robust and manu-

Fig. 6.—Igranic-Freshman Fixed Condenser.

factured from hard brass plates and selected ruby mica assembled in such a way that they are impervious to moisture and unaffected by climatic conditions. A special feature is that their capacities are guaranteed to be within 5 per cent. of their nominal values, and to remain costant over long periods.

The Manchester Electricity Supply and Tramway Undertakings.

WE have received from Manchester the reports upon the electricity supply and tramway undertakings for the year ended March 31st last.

Electricity Supply.

That of the electricity undertaking (chief engineer and manager: Mr. S. L. Pearce, C.B.E.), records a total revenue of £1,445,495, as compared with £1,473,441 in 1923-24. The working expenses decreased to a smaller extent, being £767,421 as against £722,736, reducing the gross profit from £751,305 to £678,074. The principal increase on the expenditure side was in respect of generating costs at the Barton station—from £73,895 to £111,272. The net revenue account shows increases in interest and income tax, but the contributions to sinking funds, &c., fell from £306,208 to £296,937. The total charges against the gross profit amounted to £614,606; the net revenue was thus £63,468, as against £110,721. The whole of this, as in the previous year, is transferred to reserve account. This account shows an income, with the amount brought forward and interest, of £427,613, and an expenditure of £14,651, leaving £412,961 to go forward to the next year's account. The capital expenditure during the year totalled £348,462, bringing the total up to £8,251,652. About half of this (£176,248) was expended on mains, including £23,663 for 33,000-V cables while other important items were: Transformer and distributing stations, £98,602; and services, £34,280. The generating statistics show an increase in the sales from 24,905,469 kWh to 26,816,400 kWh. The maximum demand rose from 108,320 kW to 120,390 kW, and the connected load from 233,386 kW to 258,756 kW. The load factor improved from 23.30 to 24.33 per cent. At the end of the year the total generating capacity stood at 209,150 kW.

The report states that the third turbo-generator at the Barton station was put into service in April, 1924, and early in the current year Nos. 8 and 9 boilers were brought into operation. Owing to the difficulties which were encountered with the cable transmission system during the year it was not possible to make the maximum use of the Barton station. Four new d.c. sub-stations were put into commission, two of them being equipped with automatically-operated rotary converters. Two new stations were in course of construction and will shortly be put into service, and new machines were added to a number of existing sub-stations. A number of consumers' distributing stations were built and extended. In October 1924, a bulk supply to the Stretford Urban District Council was commenced.

Tramways.

The accounts of the tramway undertaking (general manager: Mr. H. Mattinson), show that the traffic revenue amounted to £1,806,932, as compared with £1,834,846 in the preceding year, the decrease being due to the extension of the first penny stages from the town to points approximately at 1½ miles radius from the termini. The total revenue from all sources was £1,812,739, as against £1,834,846. Working expenses were £1,302,398 as compared with £1,291,871, leaving a gross profit of £510,341 (£542,975), to which was added interest on investments, &c., amounting to £15,744, and profits from the parcels department of £6,000, and from the motor omnibus service of £94, making a total of £532,239. Capital charges absorbed £289,770, leaving a net profit of £242,499, as compared with £272,943 in 1923-24, which was transferred to the renewals account. The capital expenditure during the year amounted to £190,245, the main items being £118,161 for reconstruction of permanent way, £11,718 for overhead equipment, and £41,907 on rolling stock, the total expenditure on the undertaking now being £3,198,841. The number of passengers carried increased from 294,555,718 to 305,086,307, and the car miles run from 20,927,291 to 21,110,557. The revenue per car-mile fell from 21.042d. to 20.531d. During the year nearly 8 miles of additional track was added to the system, the total mileage now being approximately 238.

A Large American Turbo-generator.—The *Electrical World* states that an order has been placed by the Brooklyn Edison Company with the Westinghouse Electric & Manufacturing Company for the largest steam turbo-generator yet ordered anywhere in the world. This unit, which is for the new Hudson Avenue generating station, will have a rating of approximately 100,000 kVA. The company already has a 62,500-kVA unit at Hudson Avenue.

The cost of the set will be in the neighbourhood of a million dollars. It will be a cross-compound machine, 67½ ft. long, 36 ft. wide and 24 ft. high. The entire set will weigh 1,855,000 lb., the largest single piece of which will be the low-pressure cylinder cover, weighing 175,000 lb. The speed of the rotors will be 1,800 r.p.m. Steam entering the turbine will be introduced at 375 lb. and at 700 deg. F. The steam consumption rate will be slightly over 9 lb. per kWh, and with four-stage bleeding the machine will produce a kWh at a little under 11,000 B.th.u. Directly connected exciters will be used, and the generators will work at 13,800 V.

Power on the Farm in U.S.A.

(Collected and Estimated Data Presented to the American Society of Agricultural Engineers.)

The probability of the materialisation of schemes for electricity distribution to the rural areas of this country renders the question of the use of power on the farm one of interest to all engaged or interested in the distribution of electricity. Electricity is used to a considerable extent by the American farmer, and the following data, which are reproduced from the *Electrical World*, will be of interest. They were presented before the American Society of Agricultural Engineers by Mr. C. D. Kinsman, senior agricultural engineer of the Department of Agriculture.

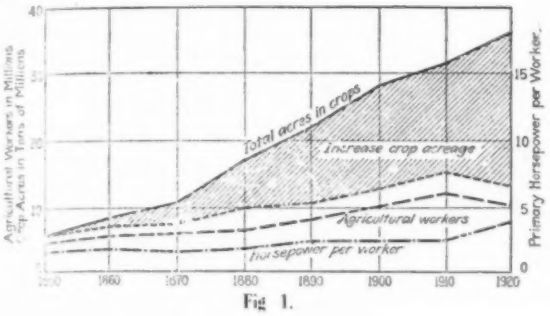


Fig. 1.

The cost of power used on farms in the U.S. is about $3,000,000 annually, and by the use of power, together with modern labour-saving equipment, the American farmer has been able to increase his production per man to at least three times of that with hand methods 75 years ago. An extremely close relationship exists between the amount of

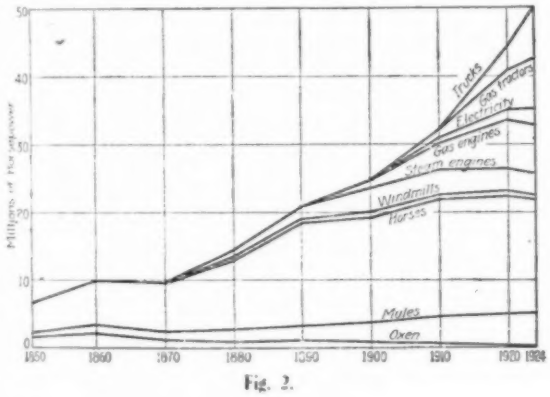


Fig. 2.

power and machinery used per worker, and the volume of crop production. In fig. 1 the shaded portion represents the increased production that is without doubt almost entirely due to the greater use per worker of power and machinery.

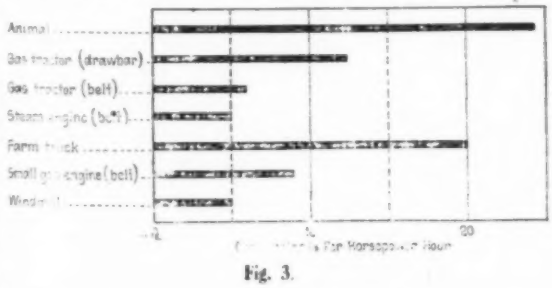


Fig. 3.

The approximate power required for various farm operations is given in the table below:—

Operation.	H.p.-hr.	
Hauling over ploughed ground	0.80— 1.30	per ton-mile
Threshing	10.00—40.00	,, 100 bushels
Elevating grain	0.20— 0.50	,, ,, ,,
Pumping water	0.01— 0.02	,, 1,000-gal.-ft.
Ploughing (clay loam) ...	9.00—13.00	,, acre
Rolling land	0.40— 2.00	,, ,,
Drilling grain	0.40— 1.80	,, ,,
Mowing	0.75— 1.50	,, ,,
Raking	0.30— 0.80	,, ,,
Corn planting	1.00— 2.50	,, ,,
Corn cultivating	1.00— 2.50	,, ,,
Potato digging	5.00— 7.50	,, ,,

Although the agricultural worker works longer hours than the worker in other industries, the value of the product of the farmer is less, and the total investment per primary h.p. in the agricultural industry is higher than in any other industry.

An estimate of the total primary h.p. that has been available on farms in the U.S. since 1850 is shown in fig. 2. It has increased from about 1.5 h.p. per worker in 1850 to about 4.6 h.p. in 1924. Approximately half of the power used on farms is for field work, ploughing being the largest item.

The approximate average power in h.p.-hr. required per acre for crop production in various parts of the United States

Fig. 4.

varies from 19 to 35 for corn (grain), 32 to 50 for corn (silage), 14 to 25 for small grain, 4 to 12 for hay, 27 to 58 for potatoes, 27 to 50 for tobacco, 20 to 30 for cotton, 38 to 40 for rice, 40 to 70 for sugar beet, and 45 to 70 for fruit.

In fig. 3 values are given for the cost of various kinds of power with which electricity is competing, which can be used as a rough guide. Local conditions and varying costs of fuel and feed will, of course, have an influence on the values given.

Fig. 4 affords a clear conception of the distribution of power on the U.S. farms, and it will be noted that there is vast room for expansion of electricity.

Legal.

Austin Baldwin & Co., Ltd., v. Greenwood & Batley, Ltd., and the Magnetic Car Co., Ltd.

In the Chancery Division on June 10th, Mr. Justice Eve tried two actions in which the plaintiffs were Austin Baldwin and Co., Ltd., Brearns Buildings, E.C.4, and the defendants (1) Greenwood & Batley, Ltd., Great George Street, Westminster; and (2) the Magnetic Car Co., Ltd., Lime Street, E.C.

Sir A. Colefax, K.C., appearing with Mr. Moritz for the plaintiffs, said that the first case would govern the second. The plaintiffs asked that the defendants should be restrained from purporting to act as licensees or sub-licensees under letters patent granted in 1915 and 1918 for electrical transmission gear. The real question was whether or not the defendants were right in their contention that they were in fact sub-licensees under these patents. They claimed to be sub-licensees of a concern called the Magnetic Transmission Co., Ltd., which had power to grant sub-licences. The licence which the Magnetic Transmission Co., Ltd. enjoyed had been declared terminated by an Order of the Court of May 29th, 1924. Counsel argued that the ordinary granting of a sub-licence could be effected only in the case where the licensee held an exclusive licence.

Sir Duncan Kerly, K.C., appearing with Mr Trevor Watson for the defendants, contended that they had power to do what they claimed under the power which was given to the Magnetic Transmission Co. to grant licences, and there was no reason why Messrs. Greenwood & Batley's licence should be dependent on the Magnetic Transmission Co.'s licence, which was the subject of an independent grant.

Sir A. Colefax said the second case, that against the Magnetic Car Co., Ltd., stood in the same position as the first case.

Mr. Turnbull, for the Magnetic Car Co., agreed that they stood or fell by his Lordship's decision in the other action.

He added that there was no reason why a sub-licence should not extend beyond the term of the head licence. The sub-licence simply meant the passing on of a permission which had been granted.

His LORDSHIP, giving judgment, said that in his opinion the licence to the defendants in each case ceased to operate simultaneously with the putting an end to the licence to the Magnetic Transmission Co. He therefore made a declaration to that effect, and granted the injunctions.

In reply to his Lordship, Sir A. COLEFAX said he did not ask for damages.

Deutsche Maschinenfabriek v. Stavers & Stavers.

MR. JUSTICE WRIGHT, in the King's Bench Division, on June 11th, heard an action by the Deutsche Maschinenfabriek, of Duisberg, Germany, against Stavers & Stavers, Cockspur Street, London, for the return of electric pulley blocks and accessories or their value, £296 10s. The defendants denied liability.

Mr. E. A. EASTHAM, K.C., for the plaintiffs, said that his clients carried on business as constructional and electrical engineers, and the defendant firm became their agents in London for the sale of electric pulley blocks and other appliances. The blocks and appliances claimed for were lent for exhibition purposes on sale or return. The agency of defendants did not prove to be successful, and they disappeared from their premises in Cockspur Street. The goods claimed for were seized by the landlord of the premises.

Mr. O. HAGAN, for defendants, submitted there was no obligation to return one of the blocks, which was faulty. With regard to the claim in detinue, he contended there was no evidence of demand and refusal, and that there had been no wrongful dealing in the goods which had been taken in execution by the landlord.

Mr. WM. M. STAVERS, of the defendant firm, stated that the exhibition blocks proved a failure owing to defective braking. They could not sell them. The whole stock-in-trade was sold by auction under distraint for about £190. Plaintiffs were claiming an absurd price for the blocks. In reply to the Judge, Mr. Stavers said he had sold four of the pulley blocks.

His LORDSHIP found that plaintiffs were entitled to succeed in their claim on contract, and entered judgment for plaintiffs for £150 and costs.

Southport Corporation v. Birkdale District Electric Supply Co., Ltd.

IT has been reported to the Southport Electricity Committee that the Birkdale District Electric Supply Co., Ltd., has given notice of appeal against the decision of the Court of Appeal granting an injunction to the Corporation in connection with electricity charges in Birkdale (*vide* ELEC. REV., May 8th, p. 732).

Belgium's Electrical Trade.

First Appearance of Classified Statistics.

HITHERTO the Belgian Government does not appear to have published separate details of Belgium's foreign trade in electrical machinery and apparatus. There have, however, recently been issued some very detailed returns of Belgian imports and exports from November 10th, 1924, when the new Customs *régime* came into operation, until the end of that year. These show the values of imports and exports, with particulars of the shares of the principal countries of origin and destination. Dealing first with the imports, it is seen that upon the whole France was pre-eminently the principal supplier, although in some sections Germany predominated. The principal item was dynamo-electric machinery, the total value of imports being 4,455,000 fr. Of this France's share was valued at 1,448,000 fr., that of Sweden at 1,053,000 fr., that of Holland at 563,000 fr., Great Britain 490,000 fr. and Germany 397,000 fr. In the cable section Germany was the principal supplier; under "submarine and underground power cable" Great Britain occupied second place with goods valued at 149,000 fr., as against Germany's 211,000 fr., in a total of 666,000 fr. Denmark supplied a goodly amount of cable. The German contribution of insulating tubes and junction boxes was valued at 107,000 fr. in a total of 114,000 fr. Holland was the chief country of origin of metal-filament lamps, 769,000 fr. out of 1,159,000 fr.; and Switzerland of meters, 179,000 fr. out of 371,000 fr. In all other sections France occupied first place, but Great Britain made a good showing in telegraph and telephone apparatus, as well as those sections already mentioned above.

On the export side the figures are not so large, and with the exception of wires and cables, lamp bulbs (as distinct from complete lamps), insulating tubes and fittings, and telephone and telegraph apparatus, the balance was adverse to Belgium. Another fact which emerges is that Great Britain took more from Belgium than she supplied. Under the heading "dynamo-electric machinery," we were by far the largest customers, receiving the equivalent of 514,000 fr. out of a total of 1,263,000 fr. Again, we took a very large proportion of Belgium's exports of wires and cables, lamp bulbs, and electricity meters, as well as the largest share of telegraph and telephone apparatus, and "other electrical apparatus or parts, with insulated metal wire windings." The principal destinations of other classes of goods were as follows:—Dry cells, Greece; accumulators, Egypt and Holland; carbons, France; insulators, Argentina; insulating tubes and fittings Germany; other insulating material, Belgian Congo; metal-filament lamps, Holland; "other measuring apparatus," Rumania; and "other electrical apparatus without insulated metal wire windings," France.

Parliamentary.

[By Our Special Parliamentary Reporter.]

Secret Wireless, Ltd.—On June 9th, Mr. DAY asked the Postmaster-General if he was aware of the formation of a new broadcasting enterprise, known as Secret Wireless, Ltd., whose stated intention was to attack what it termed the monopoly at present held by the B.B.C., and did he intend to consider the granting of a broadcasting licence to this company.

SIR W. MITCHELL-THOMSON said that Secret Wireless, Ltd., was, he understood, a company formed primarily for the purpose of developing and exploiting a new system of wireless communication; but, so far as he was aware, the system had not yet been developed on a commercial basis. Facilities for the establishment of two low-power experimental stations had been offered to the company, but this offer had not so far been accepted. No application had been made for a broadcasting licence, and the question of granting such a licence would not be entertained pending the inquiry into the future of broadcasting, which would be held this winter.

Imperial Communications.—On June 11th, in reply to Sir Harry Brittain, LORD WOLMER said that in view of the fact that most of the cable and radio services between the various parts of the Empire were or would be operated in the Dominions by private companies, he did not think it would be practicable to establish an Empire Board with executive and financial powers on the lines of the Pacific Cable Board. A standing committee, which included representatives of all the governments and companies concerned, had been appointed to consider and advise on the arrangements for the working of the Imperial Wireless Services.

Private Bill. — On June 11th, the North Metropolitan Electric Power Supply Co. Bill was read a third time in the House of Commons.

Messrs. Dennison and Morrison had put down an amendment seeking to refer the Bill back to committee with instructions that the prices chargeable to consumers should be reconsidered. They announced, however, that the company had made concessions, which while not entirely satisfactory, enabled the amendment to be withdrawn.

Mr. SCURR said that he could not let the Bill pass the House without entering a protest against the handing over of public electricity supply to private companies.

Electrical Development.—On June 15th, in reply to Mr. Morris, Mr. BALDWIN said that every effort was being made to expedite the consideration of the report of the expert committee on electrical development. In view, however, of the very important issues involved, some time must necessarily elapse before the Cabinet committee which was examining the matter could complete its labours and he was, therefore, not at present in a position to say when a report from that committee might be expected.

Current-Carrying Capacities of Solid Copper and Aluminium Conductors.

IN a paper by Messrs. S. W. Melsom and H. C. Booth, communicated to the *Journal* of the Institution of Electrical Engineers and referred to in these columns on April 20th, 1923, dealing with the efficiency of joints in bus-bars, interesting comparisons were made between the results of tests made on aluminium and copper bus-bars. It was shown that very little difference in the overlap of joints on aluminium and copper bus-bars was required to effect the same efficiency.

A supplementary paper by the same authors, "The Current-Carrying Capacities of Solid Bare Copper and Aluminium Conductors," published in the Institution *Journal* of November, 1924, is the result of observations made by the authors in testing on flat and round copper and aluminium conductors. It shows some equally interesting comparisons between the current-carrying capacities of various sizes of the two metals. Tests were first carried out to determine the rate of heat dissipation per unit area of exposed surface and the extent to which this was affected by the surface condition of the metal and in the case of the flat strips by their position, *i.e.*, whether vertical or horizontal. From the knowledge of this constant it then became possible to calculate the current-carrying capacity for any size of conductor for any given temperature-rise, the resistivity of the metal at that temperature being known.

The heat emissivity (conveniently expressed in watts) varies with the cross section of the conductor and in both round and flat bars it is greater for small than for large ones. In order

to investigate the nature and the amount of this variation all the bars available of both round and rectangular cross-section were first painted with the same special dull black paint so that the condition of the surfaces should be the same in all, and the heat emissivity for each bar was determined. The effect of the condition of the surface is shown in the following table:—

Size and type of conductor.	Condition of surface.	Watts per cm² per deg. C. (*h*).	Relative current-carrying capacity compared with original condition.
0·252 in. round aluminium bar	original	0·000343	1·00
	black (glossy)	0·000441	1·13
	black (dull)	0·000501	1·21
	special dull black	0·000552	1·27
1 in. round copper bar	slightly tarnished	0·000449	1·00
	bright	0·000423	0·97
	black (glossy)	0·000589	1·14
1 in. × ⅛ in. copper strip	original	0·000452	1·00
	bright	0·000370	0·904
	black (glossy)	0·000524	1·08
1 in. × ¼ in. aluminium strip	original	0·000355	1·00
	black (glossy)	0·000441	1·115
	black (dull)	0·000500	1·119
	special dull black	0·000541	1·24

Special allowance must be made when calculating the maximum permissible currents for bare copper and aluminium conductors because of the surface condition, also when the lead and return conductors are near each other and there is mutual heating effect.

Where ordinary black paint is used for coating the surfaces the current values given in the tables should be reduced by 8 to 10 per cent. and for unpainted bars the reduction should be 20 to 25 per cent.

Where two bars are run close together the current-carrying capacity is reduced because of the mutual heating effect and this is greater when the bars are painted black than when they are left bright, as in the latter case the radiation component of the emissivity is less.

Where two dull black bars of equal size are run side by side and the distance between the opposite surfaces is equal to the breadth of the bars, the emissivity is 6 per cent. less than when one of the same bars is run alone. The current-carrying capacity is therefore reduced by 3 per cent. If, however, the distance is increased to twice the breadth of the bar, the reduction of the emissivity is almost inappreciable and the effect on the current-carrying capacity may be neglected. When the bars are unpainted and have polished surfaces, the effect of running two bars side by side is less and may be neglected if the distance between them is not less than the breadth of the bars.

In calculating the data in the tables any extraneous draught effect has been excluded. The values given are in all cases for direct current. With alternating current the effective resistance of the conductors is increased because of the "skin effect" and the current ratings must be correspondingly reduced.

The following tables show the comparisons between some of the common sizes of aluminium and copper flat and round bars:—

Current-Carrying Capacities of Aluminium and Copper Flat Bars with dull black surfaces.

Thickness of Bar. in.	Area. sq. in.	Current Capacity Copper. A.	Aluminium. A.
¼	.125	298	255
½	.250	553	430
¼	.500	803	624
¾	1.000	1,493	1,150
1	1.250	1,820	1,410

Current-Carrying Capacities of Aluminium and Copper Round Bars with dull black surfaces.

Area. sq. in.	Current Capacity Copper. A.	Aluminium. A.
.365	118.8	92.5
1.270	322	252
2.540	864	673
3.157	1,190	927

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The History of the Telephone in the United Kingdom.

Mr. Bennett now admits the accuracy of the figures which, in his first letter, he very definitely asserted had been altered and which presented erroneous information, but he endeavours to mask the blunder of his previous allegation by ventilating a new grievance, *viz.*, that the number of telephone stations associated with the Guernsey telephone system is not included in Table 12. In the printed statistics of the Guernsey telephone undertaking supplied by Mr. Bennett expressly that I might *extract* the information I required, no mention whatever appears of telephone stations nor can the number of telephone stations be deduced therefrom. They were not included, therefore, for the very good reason that they were not supplied, and Mr. Bennett's allegation as to their omission is all the more astonishing. The figures extracted are the number of subscribers' lines, figures which are generally employed to denote the size and importance of telephone exchange systems, and I make no apology for omitting to make mention of extension lines, private lines, &c., which it is not customary to include in telephone statistics and which, as Mr. Bennett should very well know, cannot be taken as a measure of the number of telephone stations.

Mr. Bennett seems aggrieved because the Guernsey system has not been accorded the same attention as that of London, but I feel sure that all unbiased readers will readily agree that the space devoted in my book and in your correspondence columns to the Guernsey telephone undertaking is more than commensurate with its size and importance, and I beg to suggest that further waste of your valuable space in this futile correspondence originated by Mr. Bennett will serve no useful purpose and that the time has arrived when it should cease.

Wylam-on-Tyne, *June 8th*, 1925.

F. G. C. Baldwin.

[We think so, too.—EDS. ELEC. REV.]

Heating Water.

We read with interest Mr. J. E. Gilbert's letter, and as makers of the plant in question, perhaps you would be kind enough to let us make a few remarks.

As regards household requirements, certainly very good results can be obtained from coke boilers, but so also can very good results be obtained from our Bastian storage geysers.

Whether or not the running cost is actually more, depends upon the area in which they are installed, *i.e.*, the price per unit, but the Bastian geyser has the advantages that no labour of any kind is required, no dirt such as would be entailed by emptying the kitchen fire into the coke boiler as suggested, no cleaning up, more reliable service, and, in this hot weather, no unnecessary heat in the house. Are these advantages not worth something in cash?

The plant at Poplar under discussion is, of course, a large Bastian geyser, where to a yet greater extent the same advantages apply.

We submit that the correct way to look at the question is this: If heat is required, someone has to burn fuel to obtain it, and allowing for the advantages mentioned, is it cheaper to burn it locally in the house or bath establishment, or in a central station where a small amount of extra coal must be added to an already large consumption, where all known automatic stoking and labour-saving devices, &c., are employed, and where is produced under the most efficient conditions the finished article—electrical energy.

It seems to us that the time is approaching when consumers will no more think of manufacturing their own heat (as long as they can get it at a reasonable price) than they do now of making their own electric light.

Bastian & Allen.

London *June 9th*, 1925.

Lead-covered Wiring and Visible Bonding.

Dealing with the vexed question of the virtues and otherwise of the metal and non-metal systems on the market, we have employed a high-class metal system for a considerable part of our work for very many years.

The work has covered a very wide field, embracing country houses, churches, factories, schools, &c., and it would require a deal of hard thinking before we committed ourselves and our clients to a non-metal-covered system. The good wireman bonds as a matter of course; the inefficient wireman will shirk anything, and a non-metal-covered system runs just the same risk of inefficient work as does a metal-sheathed system.

Messrs. Parsons Bros.
Richard A. Parsons.

Gloucester, *June 11th*, 1925.

Luminous Electric Radiators.

Replying to your footnote in your issue of the 5th inst., *is* a bowl fire *non-luminous*? I should certainly have called it of the luminous type and herein lies the popularity of the bowl fire and the proof of the contention that a luminous radiator is preferable to a non-luminous *convector*.

Another point, Sir—can "*we*" derive comfort from *one* bowl fire of 600 watts? My experience is that for *one* person such a fire gives a very considerable amount of comfort, but it is difficult to get two persons at the focus of one fire, and outside the focus—well, the heat is non-existent.

I note you say you have measured the radiation, but, surely, the measurement taken at the focus of the bowl is no criterion of the total emission.

C. Culmer Hodges, A.M.I.Mech.E.

Electricity Works, Dawlish.
June 8th, 1925.

[Our correspondent raises points which are not strictly material to the subject under discussion, which is—"the relative efficiency *as radiators* of the two types of electric heaters." He may call the lamp type a "fire" if he likes, and the bowl fire a "luminous radiator" if he prefers it; but the essential difference is that in one case there is glass

between the source of radiation and the person who desires to be warmed, and in the other case there is no glass between them. *Glass is practically opaque to radiant heat*; it is transparent to the luminous rays, which, however, contain, "on the authority of Prof. Fleming," only 2 per cent. of the electrical energy expended.

The non-luminous convector and other red herrings have not entered into this discussion at all.

Our reference to the 600-W bowl fire related to our individual personal experiences, and there was no intention to suggest that the bowl fire was suitable for warming a crowd. The measurements that we had in mind were those of Mr. A. H. Barker and Dr. Margaret Fishenden.—EDS. ELEC. REV.]

The Electrocution of Rats.

Can any reader advise us whether a scheme for the extermination of rates by electrocution has ever been devised or put in operation, and if so, by whom?

Electro.

June 13th, 1925.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

11,354. "Telephone receivers." D. McLennan. February 25th, 1924. (233,805.)

31,651. "Means for regulating direct-current machines." P. C. Rushen (Siemens-Schuckertwerke Ges.). December 17th, 1923. (234,146.)

32,062. "Telephone systems." Western Electric Co., Ltd. (G. Deakin). December 21st, 1923. (234,151.)

32,194. "Protecting electric circuits and alternating-current machines from material disturbance of equilibrium of phase and excessive strength of current." E. Nicaise. December 22nd, 1923. (234,153.)

1924.

1,591. "Smoothing condensers for continuous-current circuits." N. Lea and Radio Communication Co., Ltd. January 19th, 1924. (234,154.)

1,765. "Electric asynchronous machines." G. B. Ellis (Sachsenwerk Licht-und Kraft Akt. Ges.). January 22nd, 1924. (Addition to 223,657.) (234,158.)

4,185. "Magneto-electric machines." F. R. Simms and Simms Motor Units (1920), Ltd. February 18th, 1924. (234,167.)

4,334. "Electric motor starters." F. B. Cox. February 20th, 1924. (234,171.)

4,913. "Means for correcting distortion of signals in electric telegraph systems." W. C. Hubbie, H. V. Higgitt, W. G. R. Jacob, and Eastern Telegraph Co., Ltd. February 21st, 1924. (234,179.)

4,578. "Automatic battery-charging switches." G. Lambert. February 22nd, 1924. (234,182.)

4,881. "Acoustic signalling." G. H. Schieferstein. July 4th, 1923. (218,617.)

4,903. "Armatures for asynchronous motors." C. Shenfer and English Electric Co., Ltd. February 26th, 1924. (234,191.)

5,268. "Electrical circuit-breakers." Metropolitan-Vickers Electrical Co., Ltd. April 6th, 1923. (213,891.)

5,528. "Pole collectors for use with electric tramway overhead conductor wires." C. E. Blackman. March 4th, 1924. (234,208.)

5,730. "Rheostats." London & Provincial Radio Co., Ltd., and E. Duckworth. March 6th, 1924. (234,213.)

5,965. "Combined electrical and mechanical couplings for electric fixtures and fittings." J. A. Crabtree. March 8th, 1924. (234,216.)

6,372. "Apparatus for measuring sound-wave frequencies." W. J. Brown, C. R. Burch, R. Connor, C. T. Melling, and Metropolitan-Vickers Electrical Co., Ltd. March 12th, 1924. (234,218.)

6,722. "Dynamo-electric machines." J. A. Kuyser, G. A. Juhlin, and Metropolitan-Vickers Electrical Co., Ltd. March 15th, 1924. (234,221.)

7,043. "Resistance for use in wireless telegraph and telephone apparatus." C. H. Gardner. March 19th, 1924. (234,223.)

7,216. "Electric cable joints." British Insulated & Helsby Cables, Ltd., and G. H. Nisbett. March 21st, 1924. (234,224.)

7,372. "Prepayment mechanisms for electricity meters." Chamberlain and Hookham, Ltd., and S. James. March 22nd, 1924. (234,227.)

8,273. "Electric starters for internal-combustion engines." J. Bate and C. A. Vandervell & Co., Ltd. April 1st, 1924. (234,235.)

8,604. "Electric cable loop-in cut-outs and like apparatus." R. A. D. Macalister. April 5th, 1924. (234,242.)

10,511. "High-tension electrical batteries for wireless and like purposes." W. D. Fox. April 29th, 1924. (234,257.)

10,841. "Protection of direct current dynamo-electric machines." Electrical Improvements, Ltd., and G. L. Porter. May 2nd, 1924. (234,259.)

11,689. "Fine-adjustment mechanism for electric coil-holders." W. G. Turner. May 9th, 1924. (234,267.)

11,682. "Electrical wave-filters." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 12th, 1924. (234,270.)

11,087. "Automatic and semi-automatic telephone exchange systems." Coventry Automatic Telephones, Ltd. (F. R. McBerty). May 12th, 1924. (233,882.)

12,279. "Process and apparatus for the insulation of accumulator plates of different polarities." C. and M. Heuzey (firm of). October 3rd, 1923. (222,826.)

12,503. "Dynamo-electric machines." E. C. R. Marks (North-East Electric Co.). May 21st, 1924. (234,278.)

12,721. "Electric condensers of fixed capacity." Igranic Electric Co., Ltd., and A. H. Curtis. May 23rd, 1924. (234,281.)

12,916. "Welding and brazing of copper and copper alloys." E. C. R. Marks (Electro Metallurgical Co.). May 26th, 1924. (233 895.)

13,325. "Collector carriages for overhead electric conductors." Railless, Ltd., A. E. Short, H. O. Short, and E. M. Munro. May 30th, 1924. (234,287.)

14,114. "Switch for use with receiving instruments in wireless telegraphy and telephony." J. Webb. June 11th, 1924. (234,291.)

14,274. "Mountings for electric switches and other fittings." M. J. Railing and J. H. Collings. June 12th, 1924. (234,294.)

14,342. "Telephone instruments." Siemens Bros. & Co., Ltd., E. A. Petithory, and F. Baker. June 13th, 1924. (Addition to 113,565.) (234 296.)

15,761. "Automatic switches for use in telephone exchange systems." Western Electric Co., Ltd. (O. Bracke). July 1st, 1924. (234,306.)

14,764. "Electroscope for the testing of insulating material." M. De Micheli. June 18th, 1924. (233,911.)

15,716. "High-frequency telegraph and telephone receiving systems." Telefunken Ges. für Drahtlose Telegraphie. June 20th, 1923. (218,329.)

18,821. "Electric illumination control systems." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 7th, 1924. (233,943.)

19,071. "Rheostats." F. S. Stuckey and Falk, Stadelmann & Co., Ltd. August 11th, 1924. (233,944.)

19,784. "Variable inductance coils." W. H. Coleman. August 21st, 1924. (234,331.)

19,806. "Measuring device in the connecting line between two electric power stations working in parallel." Landis & Gyr Soc. Anon. August 30th, 1923. (221,208.)

19 913. "Electric motors." C. A. Youldon and W. H. Pearce. August 22nd, 1924. (233,949.)

20,187. "Method of and apparatus for control of electrical conditions of a circuit or circuits." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 26th, 1924. (233,952.)

20,709. "Headlights or projectors for automobiles or other vehicles." B. Scherer. September 8th, 1923. (221,502.)

20,774. "Loading-coil cases." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 3rd, 1924. (Addition to 153,995.) (234,335.)

21,167. "Loading-coil cases for transmission systems such as telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 8th, 1924. (234,338.)

21,168. "Impulse repeaters, particularly for telephone systems." Western Electric Co., Ltd. October 6th, 1923. (222,847.)

21,858. "Telephone systems employing selecting devices." Siemens Bros. & Co., Ltd., and W. G. Patterson. September 16th, 1924. (Addition to 203,759.) (233 957.)

22,236. "Motor-vehicle lamps." F. E. Still. September 20th, 1924. (234,344.)

22,551. "Electromagnetic separators." B. Wilden. September 24th, 1924. (233,962.)

22,793. "Telephone exchange systems." Western Electric Co., Ltd. September 26th, 1923. (222,502.)

23,785. "Electric radiant heaters." Hecla Electrics Proprietary, Ltd., and C. W. Marriott. October 8th, 1924. (233,968.)

24,913. "Electrically-propelled vehicles." E. Pellone and E. Scrino. October 20th, 1924. (233,974.)

25,284. "Induction motors and the like dynamo-electric machines." British Thomson-Houston Co., Ltd. October 24th, 1923. (223,924.)

25,817. "Devices for rectifying alternating current." Naamlooze Vennootschap Philips Gloeilampenfabrieken. January 25th, 1924. (228,109.)

26,651. "Electromagnetic chemical balance." Zaidan Hojin Rikagaku Kenkyujo. November 20th, 1923. (225,204.)

26,701. "Process and apparatus for electric welding and brazing." E. Schroder. November 8th, 1924. (234,373.)

26,795. "Method for the securing of electrical conductors on terminals." Compagnie Lorraine de Charbons Lampes, et Appareillages Electriques. June 25th, 1924. (234,374.)

26,808. "Electric switches." A. P. Lundberg, G. C. Lundberg, F. A. Lundberg, and G. Pegg. November 11th, 1924. (234,375.)

27,267. "Caps or sockets for incandescent electric lamps and the like." A. J. B. Marsat. February 6th, 1924. (228,858.)

27,474. "Electric starters for internal-combustion engines." Luma-Werke Akt. Ges. November 17th, 1923. (224,922.)

28,095. "Production of three-phase alternating high-frequency current from normal homopolar high-frequency generators." C. Lorenz Akt. Ges. February 23rd, 1924. (229,633.)

28,282. "Television systems." Westinghouse Electric & Manufacturing Co. November 28th, 1923. (225,553.)

28,566. "Electric switches." International General Electric Co., Inc. November 29th, 1923. (225,563.)

28,730. "Electric machines provided with commutators." A. Fave. December 17th, 1923. (226,517.)

29,115. "Volume voltameters." Siemens-Schuckertwerke Ges. December 10th, 1923. (226,194.)

30,529. "Means for minimising the sound caused by alternating currents in electronic valves heated by alternating current." Telefunken Ges. für Drahtlose Telegraphie. December 18th, 1923. (226,535.)

30,884. "Electric switches." British Thomson-Houston Co., Ltd. December 31st, 1923. (227,098.)

30,993. "Electric transformer cores." British Thomson-Houston Co., Ltd. December 31st, 1923. (227,105.)

31,276. "Adjustable resistances for use in connection with wireless and other electrical apparatus." F. C. B. Chase and V. Pethick. December 30th, 1924. (234,010.)

1925.

3,976. "Electrical valve amplifiers." W. H. Priess. November 14th, 1923. (Divided application on 233 737.) (234,416.)

4,079. "Loop antennæ for radio reception." British Thomson-Houston Co., Ltd. March 29th, 1924. (231,437.)

5,704. "Direct-current electricity meters." S. Z. De Ferranti and Ferranti, Ltd. March 3rd, 1924. (Divided application on 5,462/24.) (234,434.)

5,708. "Means for preventing dazzle for head-lamps." W. J. Pickersgill. March 2nd, 1925. (234,426.)

7,321. "Electric motors for driving sewing machines." British Thomson-Houston Co., Ltd. March 18th, 1924. (231,168.)

Wave-form of Rectified Circuits.—The use of rectified alternating current is becoming daily more common, and a knowledge of the wave-form of the resulting direct current is essential for the user and designer alike. According Mr. C. B. W. Jolley, M.A., M.I.E.E., has attempted in the June issue of the I.E.E. *Journal* to analyse the various forms most likely to be encountered in practice; although the curves are ideal and will be more or less distorted in actuality, yet they represent facts to a reasonable degree of accuracy, or at least indicate what harmonics are likely to be present by the general method of treatment the analysis could be applied to a pronounced commutator ripple. A specialised form of wave-form, due to a rectifier where a sharp cut-off of the current is to be expected, is also considered.

The Electricity Supply Rifle League.—The following are the results of matches shot during May:—1ST DIVISION:—Central A 586, Central B 544; Central A 592, Shoreditch A 588; County 578, Central B 549; County 584, St. James' 549; County 587, Shoreditch A 580; City A 579, St. James' 555. The Central A team heads the list with 6 points (maximum possible). 2ND DIVISION:—Central C 571, Epsom 401; City B 570, Hackney 544; City B 571, St. James' 540; Shoreditch B 557, Hackney 533. The Central C team is top of the division with 6 points out of a possible 6.